

Some Methods of Dynamic Comparison in Linguistics

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The comparative method, or more accurately stated, comparative methods, since a multiplicity of them exist, have a fundamental place in the disciplines concerned with man in his social and cultural aspects. These disciplines, in contrast with the physical and biological sciences, never encounter in pure form the phenomena concerning which they seek for understanding and the formulation of regularities. Such entities as culture, society, religion, or language are always encountered in the concrete form of particular, historically conditioned cultures, societies, religions, languages, and so on. One basic approach is, therefore, the comparative one; and a fundamental purpose often served by such an approach is the uncovering of constancies of structure or of developmental tendencies underlying the individual variant forms. Hence we may study culture by means of cultures and language by means of languages.

In linguistics there are two generally recognized methods of comparison, the genetic and the typological. Both of these are associated with language classification, but the classification may be considered essentially a by-product of the application of fundamentally different criteria of resemblance. The classificational aspect is even more a subordinate matter when considered in relation to the overall purposes of the two methods. In the context of the present investigation in which certain additional types of comparison are proposed, because these do not lead to further kinds of language classification, the two latter aspects are the more important, namely the criteria of resemblance and the overall goal of comparison.

In regard to both of these, the contrast between the genetic and typological modes of comparison is of a basic nature. What constitutes a similarity for genetic investigation is determined by some theory of process, that is a theory regarding the classes of possible changes. Thus the acceptance of Latin *sex* as a cognate of Greek *hex* involves, among other things, the assumption of certain sound changes. In this instance one assumption is that Latin continues an earlier *s in essentially unchanged form, while in Greek there has been a change *s > h. Where identity is involved, it is merely the limiting case of change (i.e., zero change or stability).¹ Such a method of comparison may be classified as dynamic because it involves, in an essential way, hypotheses about change, while methods in which this feature is absent may be called static.

Of course, often the hypothesis regarding change was arrived at later in order to explain previously noted similarities; but its being so does not nullify the fact that some such hypothesis is integrally a part of the method in that the resemblance is not theoretically accounted for until a satisfactory hypothesis of change has been proposed. It will also generally hold that the genetically accounted for resemblance involves items that are highly similar, so that they could be classified together in some acceptable static scheme. But this is merely a consequence, although in practice a highly important one, of the fact that the outcomes of historical process are, on the basis of static resemblance, similar to their antecedents.

In contrast, typological criteria of resemblance involve no such hypotheses of change. Accordingly as the relevant properties are defined more widely or more narrowly, the degree of resemblance necessary to assign languages to a typological class is greater or less. Once defined, however, providing the definition meets the necessary logical requirements, a language is declared either to have the property or not to have it, without reference to considerations of change, that is, on a purely synchronic basis. Thus, if the criterion is the existence of tone as a distinctive feature of individual segments, then Chinese, Vietnamese, and Yoruba share a common class membership in the class of tone languages.

¹From the purely phonetic point of view, the data over a time span are practically never sufficient for us to posit an identity. It is often possible, however, to assert with some confidence that phonetic feature specifications have not altered through a given period, and this lack of change in phonetic feature specifications is what is intended by "phonetic identity" in the present context.

The differing concepts of resemblance inherent in these two methods are related to their general goals. The genetic comparison of individually related forms, that is, cognates, leads to the positing of reconstructed forms as the source of the later reflexes or the resultants of changes. Inasmuch as, in satisfactory applications of the method, the hypotheses are not *ad hoc* but bring together apparently disparate instances under a single formulation, historical explanations constitute acceptable answers to certain questions and exhibit the common hallmark of satisfactory explanations, namely, generalizing power as shown in the subsuming of particulars under some general rule. Thus the "irregular" plurals of internal change in English (e.g., *tooth-teeth*, *mouse-mice*, *man-men*), can be shown to arise from the same succession of changes, fronting of a vowel before *i* of the following syllable in the prehistoric nominative-accusative plural termination, followed by loss of final vowel and subsequent unrounding of the *y* [ü:] of *mȳs* and the [ö:] of **tōþ*, respectively. As is characteristic of satisfactory explanations, it "unexpectedly" also accounts for other phenomena, for example, the variation in the comparative and superlative in *old-elder-eldest* and of certain derived nouns in relation to the underlying adjective, for example, *long-length*, *strong-strength*.

Typological comparison has had a much more marginal position in linguistics, precisely because, unlike the genetic method, its overall purpose was not easily apparent; however, it now seems clear that the chief value of such comparison is its role as a heuristic for the formulation of universally valid relations among properties of language. Whenever a logically possible class of some typology is null, this same fact is logically equivalent to some statement about languages in general. So-called unrestricted universals, for example, the assertion that all languages have some phonetic segments with the vocalic feature, are merely limiting cases in which the typology is the simplest possible, that is, where there is a single predicate that takes on two values, the presence or absence of some specified property. Thus, corresponding to the above statement regarding the universality of the vocalic feature is a typology in which all languages are assigned to one of two classes defined by the presence or absence of the vocalic feature, and in which the latter class is null. The logical equivalence of null membership of certain classes in more complex typologies to implicational universals has been sufficiently illustrated elsewhere.²

²See Greenberg (1966a), pp. 9-10.

Thus both genetic and typological comparison lead to generalizations; however, there is at least one important way in which the two types of generalization differ and in respect to which, on the usual view, the explanations arising from typological procedures would be adjudged superior. The generalizations that flow from typologies approach more closely the notion of scientific law in that they are asserted to hold under general, rather than "proper-name," conditions. With regard to genetic explanatory laws, it is commonplace that regular phonetic changes, actually the only kind of linguistic regularities to which the name "law" has ever been commonly attached (e.g., Grimm's Law), hold in each instance for some specified language, or group of languages, and for a specified chronological span. This limitation would cease to exist if it were possible to specify in general terms, in principle applicable to all languages, the conditions under which changes such as those codified in Grimm's statement take place. Such general specification, of course, has not been possible.

In contrast, such an implicational universal as the one discussed later in this paper, namely that whenever a language has voiceless low vowels it always has voiceless high vowels, has the class of all languages as its scope. Its logical form may be paraphrased as follows. If we take any language, if that language has property α it has property β . Because it applies to any language, its limiting conditions are merely the definitional characteristics of language and do not involve specific constants of time and space. Hence such universals conform to the usual requirements of generality for scientific laws, while those based on genetic comparisons do not.

This distinction is no mere quibble about the use of the word "law" with its honorific connotations. Given that the conditions of application of synchronically derived universals are general, when one encounters a new language it is possible, from certain characteristics, to predict others. Such fresh data will also constitute an empirical test of the validity of the hypothesis. On the other hand, it makes no sense to ask such questions as whether there are any languages in the world which violate Grimm's Law, since it only applies to a given language during a specified chronological period.

These results would seem to be a particular exemplification within linguistics of the well-known dichotomy, described, for example, by Windelband in the nineteenth century, between idiographic, historical, particularizing disciplines and nomothetic, generalizing sciences. Within anthropology, the structuralist-

functionalist school of A. R. Radcliffe-Brown has similarly divided anthropology into two disciplines, a law-seeking, scientific, social anthropology and a particularistic, historically oriented ethnology, with an undisguised superior evaluation of the former.³

This contrast, however, as I will attempt to show, is merely an apparent one. There exists the possibility of a more comprehensive mode of diachronic comparison which shares with synchronic typology the attribute of generality. The individual items of such comparisons are not the cognate forms, but the changes themselves, as formulated in rules and occurring in historically independent cases, and hence subject to classification (corresponding to synchronic typology) and generalization without proper-name restriction. For reasons that will presently appear, it is appropriate to call such comparison processual. That this type of comparison has received only marginal and unexplicit attention rests at least partly on the preemption of the term "comparative" to particular applications of the genetic method, so that diachronic linguistics has appeared already to possess its own comparative method.

Unlike the genetic and the typological methods, the classification involved in the processual approach is not one of languages but of changes. A classificatory scheme exists, although it still stands in need of systematic reformulation, namely the traditional terminology of process, since a process is simply a class of similar changes. Such rubrics as analogical change, dissimilation of liquids, and palatalization each define a class of changes, individual members of which occur in different languages and at different times. As with synchronic typologies, we may have classificatory criteria of lesser or greater breadth. Just as the class of languages with level tones only is a subset of the tonal languages, so palatalization, umlauting, and the like are subprocesses in relation to regular, conditioned sound change.

In this study, processual generalizations are not investigated in isolation from the static universals arising from the application of typological methods. Four methods of processual comparison are proposed here, and each is illustrated by an extended example. Their status as distinct methods, as will appear from later consideration, is more pragmatic than logical, but such a classification

³It should be pointed out, however, that others, notably Kroeber, accept this division in principle but claim that anthropology is basically history rather than science, without viewing this as a defect.

should prove useful in the initial stages of development. The four methods are called here the dynamicization of typologies, the dynamicization of subtypologies, intergenetic processual comparison, and intragenetic processual comparison, respectively.

Since the first of these, the dynamicization of typologies, has been discussed elsewhere, though not under the same name, it will be treated with relative brevity.⁴ Consider any typology in which there are at least two nonempty classes among those defined by the typology. Then, for every pair of nonempty classes, we can ask a processual question regarding the mechanism of change of type in either direction. If, for example, a certain typology contains, among its defined classes of languages, three nonempty ones, *A*, *B*, and *C*, we can ask how a language of type *A* becomes a language of type *B*, how a language of type *B* becomes a language of type *A*, and so on. The number of such processual questions is evidently $n(n - 1)$, in the present instance, 6. Not all these processes need occur, however. For example, given three types *A*, *B*, and *C*, investigation might show that a language cannot change directly from *A* to *C*, but must first change from *A* to *B* and then from *B* to *C*. It is even theoretically possible, though in practice unlikely, that none of the classes can change into each other. Then, if there are n such classes in existence, there must be at least n protolanguages for mankind, so that no language in one type could have a common progenitor with a language of another type. The assumption of such fixity for any typological criterion is highly improbable and can be refuted in very many instances. For example, the relation of Persian, a non-sex-gender language, to Hindi, a sex-gender language, shows that change in at least one direction is possible in this instance.

A theory that states the set of changes by which a language can move from one typological class to another may be called a theory of relative origin because it applies to the origin of a specific type of language, a type that, in general, arises in a multiplicity of language families and chronological periods. To arrive at such a theory, we will have to compare diverse and historically independent examples which are themselves the results of comparative genetic studies in the ordinary sense. If a single, typical set of changes is found to occur in each instance, we may say that we have a theory of exclusive relative origin. Such theories are obviously the most

⁴Greenberg (1966*b*).

useful, but theories of multiple origin can also be useful, as will be shown later.

We may illustrate the dynamicization of typologies by means of the following example. Consider the synchronic typology in accordance with which languages are classified by the simultaneous application of two criteria, the presence or absence of nasal vowels and the presence or absence of oral vowels. There will then be four logically possible typological classes of languages: (1) oral and nasal vowels both present; (2) oral vowels present but nasal vowels absent; (3) nasal vowels present but oral vowels absent; and (4) oral and nasal vowels both absent.

Of the four classes thus defined, classes 3 and 4 are empty as far as present knowledge goes. Corresponding to this fact, we have the unrestricted universal that all languages have oral vowels, and the implicational universal that the presence of nasal vowels implies the presence of oral vowels but not vice versa. Because there are two nonempty classes, 1 and 2, we have two questions regarding relative origins. The first of these is concerned with change from class 1 to class 2: How do languages with both oral vowels and nasal vowels become languages with only oral vowels? In other words, how are nasal vowels lost? The second question relates to the manner in which languages of class 2 become languages of class 1: How do languages without nasal vowels acquire them?

We shall be chiefly concerned with this second question. Ferguson has already suggested a hypothesis in the form of the following diachronic universal. This hypothesis asserts that a nasal vowel "apart from borrowings and analogical innovations, always results from the loss of a primary nasal consonant."⁵ The typical course of events is as follows. A previously oral vowel becomes nasalized nondistinctively through a preceding and/or following nasal consonant. With the loss of the nasal consonant, which is the conditioning factor, a phonological contrast between oral and nasal vowel comes into existence. Where the nasal consonant follows the vowel, the sequence of changes may be schematized as follows: $VN \rightarrow \tilde{V}N \rightarrow \tilde{V}$.

It should be noted that in such diachronic universals of exclusive relative origin, no assertion is made about the period of time in which the change takes place. Indeed, if VN remained in some language indefinitely, it would not refute this thesis. It is not even

⁵Ferguson (1963).

refuted by the fact that, in certain languages (e.g., Polish), in certain environments (normally before stops), nasalized vowels have changed back into sequences of oral vowel + homorganic nasal consonant (e.g., $\bar{e}b = > emb =$). All that is asserted is that, if a language has nasal vowels, at some time in its past, if their origin can be discovered, they arise from the loss of nasal consonants in the environment of nondistinctively nasalized vowels. Such universals might be considered diachronic implications, in which certain facts about a language at time t_2 imply certain other facts about the same language at time t_1 , provided t_1 precedes t_2 at some unspecified interval. Since the implied is the hierarchically superior in an implication, the statement in terms of which certain facts at a specified time imply certain facts at a previous time, but not vice versa, is in accord with the historian's intuitive feeling that events of an earlier period explain those of a later period, and not the other way around.

The connection between synchronic and diachronic universals can be illustrated by showing how a specific synchronic universal about the relationship of oral and nasal vowels can be explained in the sense of logical deduction from a set of premises which includes the diachronic hypothesis of relative origin which has just been stated. For simplicity of exposition, I confine the illustration here to the situation in which nasalized vowels developed from the phonetic nasalization of oral vowels with a following nasal consonant, but what will be said is applicable *mutatis mutandis* to instances in which it precedes, or both precedes and follows.

The synchronic universal with which I am concerned is again one already stated by Ferguson and voiced still earlier by Hockett.⁶ It is particularly well attested, and I know of no contrary instances. It is the thesis that the number of nasalized vowel phonemes in a language is always less than or equal to the number of oral vowels.

The most frequent situation before loss of the following nasal consonant will be that in which the set of vowels which occurs with following nasal consonants is identical with the set of vowels which occurs in all other environments. If this condition holds, then, to begin with, each oral vowel will be matched by a corresponding nasal vowel. Hence the number of oral vowels is here equal to the number of nasal vowels.

Sometimes the number of vowels which may be followed by a nasal consonant is smaller. If this condition holds, then the number

⁶Ferguson (1963), p. 46; Hockett (1955), p. 90.

of nasal vowels will, in their initial period of autonomous existence, be fewer in number than the oral vowels. On the other hand, no instance is known to me of a language in which the number of vowels which may be followed by nasal consonants is greater than that of vowels which may occur in all other environments. We may, therefore, consider that a synchronic universal asserting that the number of distinct oral vowels preceding nasal consonants is always less than or equal to the oral vowels occurring in any other environment will be another premise in deducing the universal under discussion.

To this premise we must add a further diachronic factor, namely that merger among nasal vowels seems to occur more often than merger among oral vowels. A strong statement may be cast in the form of a further diachronic hypothesis. Merger between any pair of oral vowels implies the preceding merger of the corresponding nasals if they exist. Thus in contemporary French \tilde{a} has become ϵ for many speakers, merging with the latter, while the corresponding oral vowels α and ϵ have shown no such tendency. From this diachronic universal it follows that there is a mechanism that will decrease the number of nasal vowels relative to the number of oral ones, but there is none working in the opposite direction. The various generalizations just described, both synchronic and diachronic, seem sufficient as premises to deduce the synchronic universals regarding the relation of nasal to oral vowels and may, therefore, be said to explain them.

It has been noted that, in considering the problems of change of type to and from the two classes of languages under consideration, that is, those with oral but without nasal vowels, and those with both oral and nasal vowels, the two types were not, as it were, treated symmetrically. A change from the first type to the second was considered as a theory of the acquisition of nasal vowels, and from the second to the first, as a loss of the same property. In fact, it appears to be more than an arbitrary terminological convention that nasality is treated as a property and nonnasality as its negation, rather than vice versa. There is an obvious phonetic justification here. On this basis a great many instances of change of type may be viewed as coming under the general heading of acquisition and loss of contingent properties, such as nasality in vowels. Usually the proportion of languages with a contingent property is a relative minority of the world's languages.

The second method to be discussed is the intensive comparison of the languages which have such a property. It thus corresponds to the method of "comparison within the type" advocated by

functional theorists in the social sciences. In applying this method, we first consider such languages with a view to the formulation of synchronic universals concerning the property in question. We then "dynamicize" the results by procedures to be described later, in order to establish developmental courses of events typical of the subtype.

The example chosen to illustrate this method is a study of languages that have phonetically voiceless vowels. This type is one that occurs within a typology embracing all languages based on the criteria of presence or absence of voiced vowels and presence or absence of unvoiced vowels. In such a typology the class of languages with voiced vowels only constitutes the vast majority, the languages with both unvoiced and voiced vowels is a minority, and the class of languages with voiceless vowels only and the class without either voiced or voiceless vowels are both null. The universals associated with the parent typology are then the following: All languages have vowels. The presence of voiceless vowels implies the presence of voiced vowels.

This study, which makes no claim to exhaustiveness, deals with approximately fifty languages.⁷ In most of these the feature of voicelessness in vowels is nondistinctive. There are a number of languages, however, including the Keresan languages of Santa Ana and Santo Domingo, the Shoshonean languages Comanche and Ute, Mayan Chontal and Galla, and Teso and Bagirmi in Africa, in which a phonemic contrast between voice and voiceless vowels exists.⁸ On the basis of this sample, we will first seek to establish synchronic generalizations relating to voiceless vowels, and then illustrate the process of dynamicization.

⁷The sources regarding languages with voiceless vowels are enumerated in Section B of the bibliography. Footnote references to titles in this section of the bibliography are marked B. The phenomenon of voiceless vowels is probably more widespread than would appear from the literature. It is reported from every major world area. The apparent predominance of occurrence in American Indian languages is probably a by-product of the phonetic training of linguists involved in this area. It should be noted that, for certain languages listed in the bibliography, the information is too vague to be utilized for some, or even all, of the general statements proposed here, as is tacitly indicated by their omission.

⁸The existence of phonemic contrasts of voice in vowels was denied by Jakobson but asserted by Comanche specialists. On this matter see especially Canonge (1957-B). Since that time further examples have been adduced. Recently Harms (1966-B), in a binary transformationally oriented restatement of Southern Paiute phonology, has treated voicing in vowels as phonemic (I believe incorrectly).

Before proceeding further, however, some discussion of phonetic matters is called for.⁹ In general, languages have been considered to have voiceless vowels if this term is used in the phonetic description; but, as will presently appear, this criterion is not entirely adequate. The problem concerns the relation between voiceless vowels and whispered vowels on the one hand, and aspiration and *h*-sounds on the other. Presumably voiceless vowels have an open glottis with the same adjustment as for voiceless consonants, while whispered vowels involve a different glottal adjustment which includes the closing of the arytonoid part of the glottis.¹⁰ An early investigator, Harrington, in his description of Ute draws a clear distinction along these lines: "Voiceless sounds are not whispered. Whispering requires a special adjustment of the larynx."¹¹ It is evident, however, from some of the descriptions that many linguists consider the terms "voiceless vowels" and "whispered vowels" to be synonymous. Thus Andrzejewski, after describing four Galla vowels that "have no voicing," states that "several alternative terms could be suggested . . . voiceless vowels, semi-mute vowels, or whispered vowels."¹² In regard to Bannack, Liljeblad refers to certain vowels as unvoiced, and in a passage immediately following and obviously alluding to the same sound, calls them whispered vowels.¹³ Furthermore, Yamagiwa refers to vowels of Japanese which other writers have generally called voiceless as "devocalized (whispered)."¹⁴ In view of this apparent equivalence of usage, a few instances have been included in this study; for example, Karok, for which the only source describes certain vowels as whispered. Moreover, Holmer's description of Gosjiro, which contains the statement that "... final short vowels are usually voiceless (or whispered) . . .," is susceptible to interpretation either as a synonymous use of the two terms, or as free variation between voiceless and whispered.¹⁵

⁹I am particularly indebted to Paul Postal for several comments regarding voiceless vowels raised during the discussion of this paper as given orally at the 1966 Linguistic Institute at the University of California, Los Angeles.

¹⁰Smalley (1962), especially pp. 392-393 and the accompanying tapes. The study reported in Lehiste (1964), pp. 150-159, supports the acoustic distinctness of *h* and whispered vowels in American English.

¹¹Harrington (1910-B), p. 22.

¹²Andrzejewski (1957-B), p. 264

¹³Liljeblad (1950-B), p. 130.

¹⁴Yamagiwa (1942-B), p. 2.

¹⁵Holmer (1949-B), p. 51. Also the remarks of Heffner (1964), p. 85, indicate the precariousness of the distinction.

In contrast to *h*-sounds, voiceless vowels should theoretically show a lack of glottal friction. And, indeed, several sources indicate phonetic differences along this line. For example, Chontal Mayan is stated to have final segments of vowels in the utterance-final position containing "light aspiration." The same phonetic symbolization is employed here as for vowels in medial position explicitly stated to be unvoiced. It is then stated that "this aspiration is much lighter than that which is interpreted as phonemic *h*."¹⁶ In Kaiwa, aspiration and devoicing are stated to be in free variation in final unaccented syllables. They are thus treated as being distinct phonetically. A further statement concerns Cayuvava in which "voiceless trailoff" of a vowel is called "slight aspiration." Further, "this aspiration differs markedly in quality and distribution from the sound that is interpreted as phonemic *h*. It is more lenis and does not have the friction of the *h*."¹⁷

It is well known, however, that *h* as a phonetic symbol is frequently used to represent voiceless vowels of the same quality as adjacent voiced vowel segments. In this instance the difference is purely distributional. Such a view is clearly expressed by Lounsbury in reference to Oneida. "Voiceless vowels are assigned to the [h] phoneme in those positions in which their vowel color is environmentally determined but their voicelessness is not. They are assigned to the respective vowel phonemes in those cases . . . in which their voicelessness is environmentally determined but their vowel color is not."¹⁸

It we conclude, as appears necessary, that sounds assigned to the [h] phoneme in some languages in existing descriptions are, in fact, voiceless vocalic segments, then there are four possible cases: (1) Vowel color is predictable but voicelessness is not. Here we have *h*. (2) Vowel color is not predictable but voicelessness is. These are nonphonemic voiceless vowels of the quality of the corresponding voiced segments. (3) Neither vowel color nor voicing is predictable. Such segments are likewise considered voiceless vowels but phonemically distinct from their voiced counterparts, as is true of Comanche. (4) Both voicelessness and vowel color are predictable, as is true in Secoya, a language in which strongly stressed vowels have a voiceless final mora which is of the same quality as the initial voiced portion, and which only appears as a free variant before

¹⁶Keller (1959-B), p. 45.

¹⁷Key (1961-B), p. 146.

¹⁸Lounsbury (1953-B), p. 30n.

a following voiceless consonant. Such a voiceless vowel segment is to be considered an *h* because its quality is predictable, and in traditional phonemic analysis it is eliminated as nonphonemic.

We have chosen as our definitional feature for voiceless vowel, as distinct from *h*, absence of predictability of vowel quality from an immediately adjacent voiced vowel segment.¹⁹ Wherever this condition does not hold, we do not consider the sound in question to be a voiceless vowel, unless there is an explicit indication of phonetic difference from an *h* in the same language. On this basis only one instance in which the existing description specifies a voiceless vowel has been eliminated from the sample, namely, that of Secoya, just mentioned. It seems likely that, because the voiceless vowel segment in this language is always followed by a voiceless consonant, this example is to be assimilated to that of preaspirated consonants which are always unvoiced and medial.

The consistent application of this criterion eliminates one possible universal, namely, that which would assert that the existence of voicelessness in the initial portion of a vocoid implies its presence throughout the segment. What would be forbidden by this statement would include sequences of the type *ga*. These do occur but are everywhere analyzed as *ha* in practice and according to the above definition. The universals proposed here are valid, to my knowledge, for the sample considered here and do not rest on the unlawfulness of combinations that occur phonetically, but are to be analyzed as containing occurrences of segments labeled *h* according to the present definition.

We turn now to a consideration of synchronic universals relating to voiceless vowels. Basically we are looking for hierarchical preferences regarding properties associated with voiceless vowels. These may be properties pertaining to the voiceless vowel segments themselves, to sequential characteristics, or to prosodic features over longer stretches. For example, among the present results, preference for low stress over high stress refers to properties of the voiceless segments as such, the preference for adjoining voiceless

¹⁹On the basis of this definition, voiceless segments constituting "echo" vowels after the glottal stop are considered voiceless vowels because they are not immediately adjacent to the voiced vowel with which they agree in quality. Huasteco, in which there is only terminal unvoicing of the vowel segment, is considered to have voiceless vowels for present purposes, as these sounds are stated to be less fortis than the *h* that occurs in the language (Larsen and Pike, 1949-B, p. 275). For the merely heuristic value of the present definition, see note 66, below.

consonants is sequential, while that for voicelessness of the final vowel in a statement over a question intonation is prosodic. These synchronic results are summarized in a series of numbered universals, each of which is accompanied by discussion of the supporting evidence.

The first set which, in accordance with the foregoing division, refers to features simultaneous with vocalic voicelessness, has as a common motif the preference of voiceless vowels for nonculminative features, that is, weak stress, short length, and low pitch. By culminative features are meant those that figure in rules of the following type, taking stress as an example. Every phonological word has exactly one occurrence of strong stress. No such rules seem to exist for the opposite, nonculminative feature. Thus there is no language in which every word has one and only one weak stress.

1. In languages with stress, every vocalic segment that is voiceless has the weakest degree of stress.

There are explicit statements regarding the co-occurrence of the weakest stress with all voiceless vowels for the following languages: Acoma, Chama, Comanche, Dagut, Kaiwa, Nyangumata, Oneida, Papago, Southern Paiute, Tadjik, Tunica, Uzbek, and Yana. Arizona Tewa, Bagirmi, Galla, Japanese, and Teso are tonal or tonal accentual, and they are not described as possessing stress phenomena. The Yaitepec dialect of Chatino, the only one with voiceless vowels, is a tonal language with automatic stress on the final syllable. The rules are so stated that the vowel of this stressed syllable cannot be voiceless. For Totonac and Korean, neither stress nor tone is mentioned.

Cayuvava, which has been included in the sample on the strength of the statement quoted earlier that the voiceless vowel is distinct from the stronger aspiration of a true *h*, has certain occurrences of the voiceless vowel as the terminal portion of a stressed syllabic. The transcription is neutral regarding the participation in stress of the voiceless portion. There are a number of languages in which the rules as stated do not necessarily exclude stress in voiceless vowels. Nowhere, however, in the literature examined was there an example cited in which a voiceless vowel is unambiguously marked as stressed. The above generalization is considered highly probable on this basis. The absence of stress on voiceless vowels may, of course, rest merely on the physical impossibility of a voiceless vowel having sufficient prominence to produce the acoustic impression of stress.

2. *In languages with distinctive vowel length, the existence of voiceless long vowels implies that of voiceless short vowels but not vice versa.*

For a number of languages with distinctive vowel length, there are explicit or easily deducible statements regarding the nonoccurrence of voiceless long vowels. These include Bannack, Comanche, Galla, Goajiro, Japanese, Karok, Nyangumata, Oneida, Santa Ana, Southern Paiute, Tadjik, and Yana. In other cases there is no statement explicitly denying their existence, but no examples are cited. In Acoma there is a cited example of a voiceless long vowel. For all the languages with vowel quantity, however, the presence of short voiceless vowels is well attested; hence, the above implication holds. Unlike stress, there is no question of physical impossibility, as shown by the Acoma example.

We would correspondingly expect voicelessness to be favored for low-pitched, as against high-pitched, vowels. Because few of the languages with voiceless vowels are pitch languages, the evidence is necessarily limited. In view of the close relation between voicelessness and whisper in vowels, alluded to above, we have a phonetic issue closely allied to the much-discussed question regarding the preservation of distinctive pitch in whispered speech. There is a corresponding difference of opinion in the literature on the present topic. Thus McKaughan mentions voiceless allophones of *i* and *u* in Chatino "whose tone registers (if indeed they exist), have not been discovered."²⁰ In regard to Arizona Tewa, it is stated that, when a vowel or vowel cluster is completely devoiced, it has no tone.²¹ On the other hand, Tucker and Bryan give tone markings for all three levels found in the languages for the voiceless vowels of Galla, Teso, and Bagirmi. What evidence there is wholly favors low pitch over high pitch for voiceless vowels, as exemplified most clearly in Japanese, for which Han says that the "vowels *i* and *u* in low pitched *onsetsu* are regularly unvoiced between voiceless consonants."²² For Cheyenne, it is stated that single short vowels not

²⁰McKaughan (1954-B), p. 27.

²¹Yegerlehner (1959-B), p. 5.

²²Han (1962-B), p. 51. Compare also the statement of Doke (1931-B), p. 33: "A common occurrence in the Bantu languages is the devocalization (almost whispering) of final vowels, particularly *i*, when the tone in careful pronunciation would be a very low one." Trager (1940-B), p. 29, describes the final vowel in Serbo-Croatian disyllables with falling accent pattern and hence low final pitch as "very weak — often voiceless."

characterized by high pitch are voiceless in final position.²³ In other languages, for example, Karok and Chama, the unstressed vowels that are voiceless are stated to have low pitch as a concomitant feature. Such linguistic evidence appears definite enough to support the following statement:

3. *If any language has high-pitched voiceless vowels, it has low-pitched voiceless vowels.*

We now consider the quality of voiceless vowels.

4. *To every voiceless vowel in any language there is a corresponding voiced vowel of the same quality, but not necessarily vice versa.*

This statement implies that the number of voiceless vowels never exceeds the number of voiced vowels in any language, and parallels the relationship of nasal to oral vowels. The present statement is, however, stronger in that one fairly commonly finds nasal vowels that do not match any oral vowel in quality, whereas in our sample every voiceless vowel can be matched by a voiced vowel of the same quality.

5. *The existence of voiceless vowels of less than the maximal degree of vowel height implies the existence of some vowels of the maximal degree.*

The favoring of high vowels with regard to voicelessness is apparent in table 1, which includes all the languages of the present sample in which voiceless vowels do not occur with all the qualities of voiced vowels.

²³Davis (1962-B), p. 36. The inference here is that low-pitched final short vowels have *become* voiceless. There is no indication that these voiceless vowels have distinguishable pitch.

TABLE 1
HIGH VOWELS AND VOICELESSNESS

Language	Voiceless and voiced	Voiced only
Awadhi	<i>i, u, e</i>	<i>a, o</i>
Campa	<i>i</i>	<i>o, e, a</i>
Chatino	<i>i, u</i>	<i>o, e, a</i>
Dagur	<i>i, u, e*</i>	<i>o, a</i>
Huichol	<i>i, ʌ, e**</i>	<i>u, a</i>
Serbo-Croatian	<i>i, u†</i>	<i>o, e, a</i>
Tadjik	<i>i, u, a</i>	<i>e(:), o(:), ú(:)‡</i>
Tunica	<i>u</i>	<i>i, e, ɛ, a, ɔ, o</i>
Uzbek	<i>i, u</i>	<i>e, ɔ, o, a</i>

*I follow Martin's symbolization here; *e* is phonetically [ə].

**Huichol /ʌ/ is described as a high, central, unrounded vowel in McIntosh (1945-B).

†Trager (1940-B) seems to imply, however, that all Serbo-Croatian vowels may be voiceless under certain accentual conditions.

‡Since the investigations of Polivanov, it has become customary to categorize the Tadjik vowels *e, o, ú* as stable in contrast to *i, u*, and *a*, which are categorized as unstable. Traditionally the former were considered long, and the latter, short; and the comparative evidence suggests that this was formerly true phonetically. The stable vowels do not differ in length from the unstable in stressed syllables. In unstressed syllables the unstable vowels are subject to voicelessness in an unvoiced consonantal environment and quantitative reduction or loss in general, while the stable vowels are only slightly shorter than in stressed syllables. We may conjecture that the unstable vowels became voiceless in a period when the phonetic distinction was still one of length in all environments.

Additional evidence for the favoring of high vowels can be found in some instances in which voiceless vowels exist with all the same qualities as voiced. In Japanese and Papago, the high vowels are devoiced in a more extensive set of environments than low vowels. Regarding Japanese, Gensen Mori states that "... *a* is subject to devocalization in a lesser degree than *i* or *u*. Those who regularly devocalize *i* and *u* in certain positions will not always do the same with *a*."²⁴ For Comanche and Nyangumata there are explicit statements that the lowest vowel *a* is much more rarely devoiced than the others. In Shawnee, of the four vowels *i, e, a* and *o*, all of which are pausally devoiced, only *i* exerts a further regressive force in devoicing a vowel of the preceding syllable under certain conditions.

We now consider some environmental limitations on the appearance of voiceless vowels.

²⁴Mori (1929-B), p. 41.

6. *Every voiceless vowel is either preceded or followed by silence or a voiceless plain (i.e., nonglottalic) sound.*

For example, no voiceless vowel occurs between two voiced consonants. In some languages the stronger statement holds that every voiceless vowel is both preceded and followed by a voiceless plain sound or silence. Silence almost always follows, rather than precedes, because, as will be shown later, a favorite position for voiceless vowels is utterance final, while occurrences in utterance, or indeed in word initial are excessively rare.²⁵ Among the languages for which this stronger statement holds are: Acoma, Cayuvava, Chama, Chatino, Chontal, Comanche, Huasteco, Japanese, Nyan-gumata, Pame, Serbo-Croatian, Tadjik, Tunica, Ute, and Yana.²⁶ In some of these languages, voiceless allophones of otherwise voiced nasals, liquids, and semivowels are found adjacent to voiceless vowels.

The preceding statement also excludes the occurrence of voiceless vowels flanked by two glottalized consonants, glottal stop and glottalized consonant, voiced consonant and glottalized consonant, or voiced consonant and glottal stop. There is additional evidence regarding the disfavoring of voiceless vowels adjacent to glottalic sounds. In Acoma only plain consonants occur before final unvoiced vowels, and nonfinal vowels are devoiced only when neither preceded nor followed by glottalic consonants.²⁷ In Chatino *i* and *u* are unvoiced in unstressed syllables, provided the following consonant is not a glottal stop. In Papago *i* and *ɨ* are voiceless in pause, except after a laryngeal. In Southern Paiute after a glottal stop preceded by a vowel, a final vowel is said to be only partly reduced in voice, becoming a "murmured" vowel.

The tendency of vowels to voicelessness is particularly powerful in the final of words and of longer units such as sentence or utterance. For many of the languages, voiceless vowels can only occur in the final position of some such unit. Thus, in the following languages, voiceless vowels appear only in the final position of utterance, sentence, or some extensive intonational contour: Arabela, Arizona Tewa, Basque, Galla, Hawaiian, Huichol, Ignaciana,

²⁵The only examples encountered were in Southern Paiute.

²⁶It is not clear from Harrington's description whether voiced consonants occur adjacent to voiceless vowels in Ute.

²⁷More precisely, a final vowel can be devoiced only if the preceding consonant is a plain aspirated occlusive or /h/. A short, unaccented vowel that does not come after the last accent is optionally devoiced if it is preceded and followed by plain obstruents (Miller, 1965-B, pp. 16-17).

Kaiwa, Karok, Maori, Nyangumata, Oneida, Shawnee, Tunica, and Yana. Languages such as Shawnee, in which voicelessness extends to nonfinal vowel under specified conditions and only when the final vowel is itself voiceless, have been included here.

In most of the languages of the foregoing list, there are further limitations, so that finals are unvoiced only under certain conditions. These limitations are usually in terms of variables already mentioned. For example, in some languages only unstressed final vowels are devoiced, or only high final vowels, and so on. For another considerable group of languages, voiceless vowels occur only in the word-final position, thus embracing a fortiori final position in longer units. These include Bagirmi, Bannack, Campa, Chama, Cofan, Huasteco, Serbo-Croatian, Teso, and Totonac. Most of the remaining languages of the sample have voiceless vowels in both word-medial and word-final positions. Where they do, final occurrences are more frequent, sometimes overwhelmingly so. There are, however, four languages, Mayan Chontal, Chatino, Tadjik, and possibly Japanese,²⁸ in which voiceless vowels occur in initial and medial position, but not in word-final position. Chatino and Tadjik share the feature of regular final stress, and it has been seen that voicelessness is incompatible with loud stress. Mayan Chontal has most commonly, but not exclusively, final stress. Japanese will be considered later for its methodological interest. For the moment, we consider it a possible exception to the following generalization.

7. If a language does not regularly have high stress on the word-final syllabics, then, if it has voiceless vowels in word initial, it has them in word medial; if in word medial, then in word final; if in word final, then in the final of some longer unit or units such as an intonational contour, sentence, or utterance.

The disfavoring of laryngeal sounds, including the glottal stop in the environment of voiceless vowels, was discussed earlier. In sentence-final position, a special relationship of opposition sometimes exists between glottalization and voicelessness. For example, in Chama "the plain glottal stop distinguishes the open juncture terminally when it is preceded by a primary stressed vowel or when the final vowel is not unvoiced under weak stress."²⁹ In other words, a final, unstressed vowel varies between voicelessness and voicing

²⁸Japanese is included on the basis of Bloch's analysis; however, some earlier accounts indicate the presence of voiceless vowels in word final, e.g., Lange (1903), p. xvii.

²⁹Firestone (1955-B), p. 53.

followed by the glottal stop. In Arabela, a nondistinctive glottal stop appears in most sentence finals and is incompatible with voicelessness of the preceding vowel. In Karok, whereas a short final vowel is optionally devoiced, a long vowel is voiced and glottalized. In Bannack, final unstressed vowels vary freely between voicelessness and voicing. In the latter instance, the preceding consonant is glottalized. In Oneida, in pause a final glottal stop is lost, and the preceding, now final, vowel becomes voiceless. In some instances, the two alternatives of voicelessness and glottal closure are connected with types of sentence intonation. In Nyangumata, in which most sentences end in voiceless vowels, glottalization occurs in place of voicelessness most commonly in questions and accompanied by rising intonation. In Walapai, there is a similar opposition, though without concomitant glottalization. Terminal statement juncture has decrease in stress, pitch, and voicing. Question final juncture is characterized by a sharp rise in pitch and amplitude, and there is no devoicing. A parallel situation exists in Galla. Those short, final vowels that are subject to voicelessness have this characteristic in statement-final position but keep their voicing in the corresponding yes-no question. Those short final vowels that are not subject to devoicing retain it in statements and are replaced by the paired long vowel in the corresponding yes-no question. In Mikasuki, a Muskoghean language without voiceless vowels, "the glottal catch occurs most frequently with questions of the type 'Is it a _____?' and 'Is he _____ing?,' in which a tone change often combines with glottal catch to change a statement to a question."³⁰ The further observation is made that a terminal vowel with falling tone indicates "rest" or "completion," while level tone with following glottal stop indicates "nonfinality." These phenomena are evidently allied with the "rhetorical lengthening" described by Sapir for Southern Paiute. "Final vowels, instead of being elided or unvoiced, are sometime, for reasons of rhetorical emphasis, lengthened and generally followed by a glottal stop."³¹

Just as the preferred position for voiceless vowels is final, so that for glottal stop is initial. The existence of glottal attack for the vocalic sentence-initial or word-initial position is a well-known phenomenon. A particularly striking example in the present sample is Totonac, in which all word-initial vowels are laryngealized, and all sentence-final short vowels are voiceless. Corresponding to the

³⁰West (1962), p. 86.

³¹Sapir (1930-B), pp. 20-21.

preference of voiceless vowels for nonculminative prosodic elements is the widely reported occurrence of glottal accent in which glottalization fulfills the function of a culminative pitch accent. This complex of oppositions is diagramed in table 2. The manifold connections involved in table 2 suggest a number of possible universals. In the present connection, only those involving voicelessness are considered. The connections between voicelessness and final position, and weak stress and shortness in vowels have already been stated. The following additional universal holds on the basis of the evidence just cited.

TABLE 2
COMPLEX OF OPPOSITIONS BETWEEN VOICELESS VOWELS
AND GLOTTAL STOPS

Marked	Unmarked
Initial	Final
Glottalization	Voicelessness
Question	Statement
Emphatic statement	Normal statement
Rising pitch	Falling pitch
Strong stress	Weak stress
Vowel length	Vowel shortness

8. *The presence of voiceless vowels in the final of yes-no questions implies their presence in the corresponding statements.*

As a final observation concerning synchronic generalizations about voiceless vowels, it may be pointed out that in Yana voiceless vowels occur in "woman's speech" but not in "men's speech." What is meant here by woman's speech is that of women talking to women, men to women, or women to men. Men's speech comprises only those instances in which men speak to men.

Thus far, the method of subtypologies has been applied in a purely synchronic manner. Comparison of a set of languages containing voiceless vowels has led to the formulation of a number of synchronic universals concerning them; however, every implication in which both the implying and implied have empirical exemplification can be mapped into a diachronic process by which the former develops from the latter. For example, from the synchronic universal that voiceless vowels of lower tongue heights imply those of the highest tongue height, we can frame the hypothesis that voice-

lessness in vowels begins with those of the highest level and then spreads to the others. This statement is a hypothesis, because there is nothing contradictory involved in the assumption that in some languages only the high vowels become voiceless, while in others all of the vowels become voiceless through a single change. What is excluded, though, is the hypothesis that low vowels are the first to become voiceless and that voicelessness subsequently spreads to high vowels. If this latter statement were so, such languages in the initial stages would have low voiceless vowels without having high ones and thus contradict the original hypothesis.

The relevance of the proviso that both implied and implied must have empirical exemplification can be shown by reference to the universal regarding stressed and unstressed voiceless vowels. The implication that every language with stressed voiceless vowels has unstressed voiceless vowels holds. There are, as has been seen, no authenticated examples of stressed voiceless vowels. Hence we cannot hypothesize that languages first have unstressed voiceless vowels, and that voicelessness then extends to stressed vowels because this, as a limiting case, is a hypothetical stage that is never reached.

Purely synchronic evidence can be relevant in demonstrating that the hypothesized succession does take place. There are, here, two assumptions which, for phonological change at least, receive considerable support outside of the present examples. The first of these is that, whenever a sound change takes place, the older form and the innovating form are, for a period of time, in free variation, with the innovating free variant increasing in frequency until the change is accomplished. Hence, if in one environment variation is free, while in another complimentary distribution shows that the change has been accomplished, change in the first environment must be more recent. The other assumption has to do with style. The situation is no doubt more complex than the mere coexistence of two styles, *lento* and *allegro*; however, it is only in reference to this distinction that a large body of data exists which can be exploited for theoretical purposes. There is much evidence in the area of phonology which shows that the *allegro* form is the innovating form which only later spreads to the *lento* style. Both the free variation and style assumptions can be neatly documented from the detailed observations regarding voicelessness in Japanese vowels made by Bloch and summarized in table 3.

TABLE 3
FREE VARIATION AND STYLE ASSUMPTIONS

Vowel type	Speech style	
	Lento	Allegro
Low	<i>a</i>	<i>a</i> > <i>A</i>
High	<i>I</i> < <i>i</i>	<i>I</i> > <i>i</i>

Here, *a*, *A*, *i*, and *I* represent voiced low vowels, voiceless low vowels, voiced high vowels, and voiceless high vowels, respectively. The symbol > means "more frequent than," and < means "less frequent than."

The information in table 3 may be stated as follows: The voiceless high vowels are more frequent than voiced high vowels in allegro, less frequent in lento. The low vowels are voiced only in lento. They occur in allegro; but, unlike the high vowels, the voiceless variants are less frequent than the voiced. We may translate these assertions into dynamic terms as follows: The high vowels have progressed further in becoming voiceless than the low vowels, inasmuch as they have penetrated into lento from allegro, although they are still less frequent in the former style than the latter. The voiceless low vowels have not yet penetrated the lento style, and even in the allegro style, unlike the voiceless high vowels, they are still less frequent than their voiced variant.

Note that these data constitute an empirical confirmation of the thesis that innovations first appear in allegro, then in lento. The hypothesis arrived at independently of the present evidence from a variety of languages was that voicelessness in vowels could not begin with low vowel because such a beginning would produce, in the first stages, a nonexistent language type. Had, for example, low vowels in voiceless form been found in lento but not in allegro, or had low voiceless vowels been more frequent than their voiced correlates in either lento or allegro, while the reverse held for high vowels, our thesis about the relation between lento and allegro styles would have been empirically refuted.

In these instances, in which the nonpreferred or implicating state is not known to exist, we must construct our historical theory in such a manner that we do not assume its existence at any stage.

Thus, as was pointed out earlier, the language state mentioned in the *implicans* of the universal that stressed voiceless vowels imply unstressed voiceless vowels has no empirical realization. As far as appears from the present materials at least, there are no instances of stressed voiceless vowels. An application of this principle can be made in Southern Paiute. In this language internal evidence shows that an original system of high stress in alternate syllables existed before the unvoicing of certain vowels. Stress is now found in the syllable preceding that of the voiceless vowel in those instances where the general rule would predict a stress on the voiceless vowel. It is evidently inadmissible here to posit the following sequence of events: voiced stressed vowel, unvoiced stressed vowel, shift of high stress to preceding syllable leaving the voiceless vowel with low stress. We must rather posit a simultaneous change in stress and voicing, so that the historical sequence is that a voiced, high stressed vowel becomes an unvoiced, low stressed vowel, and the stress moves back to the preceding syllable. In such instances, we may talk of correlated changes, that is, of unvoicing with simultaneous change from high to low stress in vowels.

Since the aim of this study is primarily methodological, I do not propose to treat all of the changes in unstressed vowels which may be investigated by means of comparison within the subtype of languages with voiceless vowels. In addition to those already mentioned, it is of interest to note the existence of evidence in the form of free and style variation that voiceless vowels tend to be replaced by zero (i.e., lost). In Shoshone, voiceless vowels maintained in careful speech (i.e., *lento*) are suppressed in ordinary conversational style, whether intervocalic or final.³² In North Carolina Cherokee, without reference to style difference, vowels preceding phrase boundary are often "whispered or dropped."³³ In Goajiro, they are "whispered and eventually suppressed."³⁴ In Dagur, the vowels subject to unvoicing (*i*, *u*, *e*) "often seem to disappear, especially in rapid speech."³⁵ As noted by Gensen Mori for Japanese, "from devocalization to complete elimination is but a single step."³⁶ According to Yamagiwa, once more in reference to Japanese, "*i* and *u*

³²Shimkin (1949-B), p. 175.

³³Bender and Harris (1945-B), p. 17.

³⁴Holmer (1949-B), p. 49.

³⁵Martin (1961-B), p. 16.

³⁶Mori (1929-B), p. 22.

are often 'devocalized' (whispered) or lost between two voiceless consonants."³⁷

In Cheyenne, a voiceless front vowel following *t*, *s*, *š*, *m*, *n*, or *w* is "very unstable." Forms that in careful speech contain a vowel in this position often lose the vowel in rapid speech. This loss is normally accompanied by a compensatory lengthening of the previous consonant, for example, *něšē~něs*.³⁸

It was noted earlier that Japanese was the only language that constituted an exception to the universal according to which languages with voiceless vowels in word-medial position also possess them in word-final position. In view of the evidence just cited regarding the tendency to loss of voiceless vowels, the explanation is now evident. Voiceless *i* and *u* formerly existed in word final but have already been lost precisely because this position is the one that is favored and the one in which they are likely to appear first.

In such forms as *x·tots* ("one"), and *arimas* ("is"), cited by Bloch, there is both internal evidence in the form of a distributional gap (the nonappearance of word-final **tsu* and **su* in Bloch's material), and external evidence from the kana orthography, of the loss of final *u* after an unvoiced consonant. Bloch gives *hatš* ("eight") as an allegro form in alternation with *hatši*. That these final vowels were formerly devoiced is made likely by the coincidence of the conditioning factor with that operative in word medial in present free variations, and from the earlier observation of Gensen Mori regarding devoicing, particularly of *u*, "at the termination of a breath-group." Moreover, Mori gives examples like *mošĭ* and *mainitšĭ*. For a still earlier period, R. Lange observes that "final *ssu* usually loses the vowel and becomes *ss*, and the vowel in final *tsu*, *shi*, and *chi* is barely audible."³⁹ It may be noted that the consonantal length specified by Bloch in instances where a following voiceless vowel has been lost is exactly parallel to the situation in Cheyenne already referred to.

As can be seen in Japanese, the true regularity lies in the dynamic tendency rather than in the static situation. It is not merely that an exception is "explained" by reference to historical process. The implication is that the valid generalization pertains to the form and the conditions in which a historical change occurs.

³⁷Yamagiwa (1942-B), p. 2.

³⁸Davis (1962-B), p. 36.

³⁹Lange (1903-B), p. x.

Reverting to the tendency to loss of voiceless vowels, the suggestion may be advanced that, in many historical instances of loss of vowels, there was, in fact, a period of voicelessness which could not find expression in the orthography. A number of conditions fit quite exactly. The greater tendency of final vowels, unstressed vowels, and short vowels to loss hardly needs documentation. There is also some evidence that high vowels are more easily lost than low vowels, and such loss is a well-known phenomenon in Romance languages. Meyer-Lübke summarizes the situation regarding final vowels in the statement that “l’*a* est la plus résistante des voyelles finales.”⁴⁰

The only important respect in which a real difference seems to exist between the conditions for voicelessness in vowels and the conditions for vowel loss is in the preference for a voiceless consonantal environment for the former which does not appear in most formulations regarding vowel loss. The fact is that the rule for vowel loss in modern Japanese requires a previous voiceless consonant as a conditioning factor, and in this instance we can be sure that loss was preceded by voicelessness of the final vowel. This fact suggests that there might be two types of vowel loss: one with a stage of vowel voicelessness and another without. In some instances of final vowel loss, the preceding consonant has become voiceless. For example, in most of Slavic at least the obstruents that preceded the disappearing final *jers* (*i* and *ū*) appear as unvoiced in word final (e.g., *rogŭ* > *rog* > *rok*, “horn” in Russian). The *jers* would seem to be good candidates for voicelessness before loss, since it is precisely the high and shortest vowels in word final which are affected.⁴¹ Considering the frequency of regressive spread of voicelessness, it is reasonable to assume, instead of the succession of events as described above in accordance with the usual formula, rather *rogŭ* > *rogŭ* > *rogŭ* > *rog* > *rok*. Since the voiceless *g* was lenis, it would still be distinguishable for a time from *k*, and would hence be retained in orthographies. In languages such as Serbo-Croatian, voicing could have been restored analogically from forms in which it was never lost (e.g., from *roga*, “genitive singular”).

The detailed instrumental phonetic observations of Sokolova on Tadjik, however, show that whereas unstressed short vowels in

⁴⁰Meyer-Lübke (1890-1906), I, 260.

⁴¹The *jers* are always lost in vowel final. They were also lost in so-called weak position word internally, that is whenever there was a full vowel (non-*jer*) in the next syllable.

an unvoiced environment varied between voicelessness and complete loss, in a voiced environment the same vowels varied between a fully voiced variant and loss, though such loss was substantially less frequent.⁴² This fact perhaps indicates that under otherwise favorable conditions for vowel voicelessness this loss occurs in a voiceless consonantal environment, while loss without a stage of vocalic voicelessness takes place in a voiced consonantal environment.

Further investigation is obviously required in this instance, but the theoretical point to be made is that the vast literature of synchronic description, with its numerous instances of free and style variation, is capable of throwing important light on the phonetic nature of sound changes of the past which are only known from documentary sources. The principles involved may be illustrated by another example. Even if we had no historical evidence of an intermediate *h*-stage, in considering the correspondence of *s* in Romance and other Indo-European languages with modern Greek zero (e.g., Italian *sette*, Modern Greek *eftá*, "seven"), we should assume ($s > h > \text{zero}$) for Greek, rather than, directly, $s > \text{zero}$. There are well-attested instances of free variation $s \sim h$ and $h \sim \text{zero}$ in contemporary languages but apparently none of $s \sim \text{zero}$.⁴³

We may briefly compare the two methods that have been discussed up to now, the dynamicization of typologies and of subtypologies. In both we are interested in the establishment of lawful

⁴²Sokolova (1949-B). In voiced environments, in addition to less frequent loss of unstable vowels, where these vowels are not lost, their duration is significantly greater. The greater length of vowels in voiced environments, particularly before voiced consonants, is a widely known phenomenon.

A supporting instance for the hypothesis that final vowels are more likely to be lost after unvoiced consonants may be found in the German loss of final unstressed vowel. Modern Standard German is rather irregular in this regard, but Paul noted that there was a preference for the retention of the vowel after *b*, *d*, *g*, and *z* (Paul and Stolte, 1951, p. 74).

Furthermore, Whiteley's material on Ci-miini, a dialect of Swahili, indicates that *i* and *u* have been lost before unvoiced, and not before voiced, consonants (Whiteley, 1965).

⁴³Of course free variation is not the only source of internal evidence for sound change. Complementary distribution resulting from accomplished conditioned change, and morphophonemic alternations representing still older processes, are also relevant. Free variation, however, is the only internal source regarding unconditioned merger, and it also provides the most direct information about the phonetic conditions of change because there has been, as yet, no chance for intervening phonetic changes.

successions of types. This statement was not made explicitly with regard to the subtypological method but should be evident. For example, the statement that voiceless low vowels imply voiceless high vowels but not vice versa, and the dynamic evidence that there are instances in which voicelessness spreads from high to low vowels but not vice versa, can be restated in terms of typology. The language type defined by the presence of voiceless high vowels may be succeeded by the type in which all vowels may occur voiceless, but the opposite succession of types is excluded. In the subtypological method, however, the pragmatic emphasis was on the discovery of significant types and their successives based on typological comparison. In the first method, the types were treated as given, and the mechanism of change of type was investigated. A further difference was the emphasis on the use of the comparative and direct historical approach in the first method. The origin of nasal vowels was to be investigated chiefly by comparing the results of historically independent instances of reconstruction and of historically documented examples of change. In the subtypological method, the emphasis was on the use of internal change phenomena for individual languages without essential regard for their genetic connections. In fact, both methods can be utilized for either case, for internal reconstruction with regard to nasal vowels and for the comparative study of voiceless vowels. For the latter, comparative study of the Keresan and Shoshonean languages, which has already been initiated, is a potential source of enlightenment regarding the problems considered here.⁴⁴

The third method that will be illustrated is that of intragenetic processual comparison. Historical independent reconstructions are compared as a test of the extent to which they are mutually corroborative, and to help in the selection among mutually exclusive hypotheses in individual instances by reference to other typologically similar cases. As with the other methods with which we are concerned, the emphasis here is dynamic, that is, we compare lines of development rather than reconstructions viewed statically. It has been proposed, as a basic contribution of synchronic typology to historical linguistics, that synchronic universals serve as a touchstone for the validity of reconstructed systems.⁴⁵ And it is certainly true that a violation of principles, valid for directly documented lan-

⁴⁴See Davis (1966-B) and Voegelin, Voegelin, and Hale (1962-B), p. 48, for Uto-Aztecan, and Miller and Davis (1963-B) for Keresan.

⁴⁵Cf. Jakobson (1958).

true that a violation of principles, valid for directly documented languages, precisely for an only indirectly attested language is always a suspicious circumstance which throws doubt on the reconstruction.

This criterion has been applied to Proto-Indo-European; but the question we shall ask here is not the one hitherto and quite justly asked, namely, whether the reconstructed Indo-European phonological inventory conforms to the universal norms of such systems. Instead we will ask whether the sequence of changes in the key instance of laryngals is plausible when considered with reference to other reconstructible or historically documented instances of change. A study that would illustrate this method should ideally be complete in that all instances of changes in systems of laryngals accessible to internal reconstruction, direct historical documentation, and comparative reconstruction should be included. In keeping with the present purpose, however, which is merely illustrative, a single non-Indo-European instance will be considered, that of Coptic, and only in limited detail. There will also be occasional reference to non-Coptic materials.

The Coptic data are of special interest from the methodological point of view for the following reason. They have come down to us in the form of five literary dialects, from the comparison of which it is possible to construct at least the general outlines of a Proto-Coptic. The Coptic dialects do not have laryngeal consonants; but, as will be shown here, a comparative study will lead to the reconstruction of several consonants not known in existing dialects. In this instance earlier Egyptian, as written in the hieroglyphic script and the structurally equivalent hieratic and later demotic, attests their actual existence where they would be postulated on the basis of Coptic, and the comparative evidence of Semitic and other Afro-Asiatic languages, as well as the transcription of Semitic words of an earlier period, gives evidence regarding their phonetic nature.

The results presented here are part of a more extensive reconstruction effort. All previous work has been in terms of tracing the Egyptian antecedents of items found in Coptic. It has doubtless been done with substantial correctness, and the changes posited here do not differ in essentials from those usually assumed. Such an independent comparison of Coptic dialects in relation to Ancient Egyptian is similar in procedure to that of Romance linguistics in relation to Classical Latin. This approach is even more justified in the present instance because of the defective and arbitrary nature of hieroglyphic and demotic orthography.

We shall be chiefly concerned with two Proto-Coptic vowels symbolized here as **ɔ̄* and **ε*, and we shall proceed by the discussion of a number of instances of correspondences among the dialects. The five standard literary dialects will be indicated by their usual abbreviations, and forms will be cited in accordance with a transcription system described in the accompanying footnote.⁴⁶

1) SB³, AA²F⁴ *á*. **ɔ̄*

Every Coptic word has a single high stress on one of the last two syllables. All other vowels are reduced, and in reduced position only a limited set occurs, for example, never *ɔ*, *o*, or *e* in any dialect in native words. When, as for example in compounds, a form with *Vy* or *Vw* diphthong occurs with low or (possibly) intermediate stress, the vowel may be lost and the *y* or *w* become syllabic. Compare, in S¹ *stáj* ("smell") with *stì-núfā* (lit. "smell-good," i.e., "perfume").

The above correspondence never occurs in word-final position, and it never occurs before certain consonantal correspondences. Examples containing *l* are:

1a) SB *són*, AA²F *sán* ("brother"). **són*.

1b) S *sótmeʃ*, B *sóthmeʃ*, AA²F *sátmeʃ* ("to hear him"). **sótmeʃ*.⁴⁷

1b contains the third person masculine dependent form *-(ə)ʃ*. The aspiration in Bohairic *th* is automatic before any sonant.

2) SBAA² *á*, F *é*. **ɔ̄*

Correspondence 2, unlike 1, is not restricted to nonfinal position. When nonfinal and followed by a consonant, it is limited to environments in which one of the three following consonant correspondences occurs, these being precisely the environments in which 1 is not found. These three correspondences are:

3) SBAA²F *h*. **h*

4) SA²F *h*, BA *x*. **x*

5) SBA²F *š*, A *x*. **ç*

⁴⁶The abbreviations used for the dialects are as follows: S, Sahidic; B, Bohairic; A, Achmimic; A², Subachmimic; F, Fayumic. The transcription is self-explanatory except for the following: The vowel symbols *epsilon* and *eta* are rendered as *ε* and *e*, respectively, and *omicron* and *omega* as *ō* and *o*. Geminate vowel writings are transcribed by length. For a justification of both of these interpretations, see Greenberg (1962). The supralinear stroke that apparently symbolizes a reduced vowel is transcribed *̄*. *Beta* is rendered by *b*, although its phonetic value seems to have been a bilabial unrounded semivowel. For a standard account of vowel changes from Egyptian to Coptic, see Steindorff (1951). What is said here regarding the development of Egyptian laryngeals is subject to the qualification that it is not impossible that laryngeals still survived in Coptic, particularly in Achmimic. On this see Till (1929).

That 1 and 2 represent the same protophoneme is shown not only from this complementary distribution but from morphophonemic alternations. No verb of the same class as **sʔtm(ə)f* (1*b* above) occurs with correspondence 1 before **h*, **x*, and *ç*, but instead correspondence 2 makes its appearance. The following is an example in which 2 is followed by **h*.

2*a*) S *náhməf*, BAA² *náhməf*, F *néhmeç* ("to save him").
**nʔhm(ə)f*.

All of the dialects except B have long vowels indicated orthographically by geminate vowel symbols. Long vowels occur only as the syllabic of stressed syllables, and they never appear in word-final position. Among the correspondences involving long vowels is the following:

6) SAA² *á:*, B *á*, F *é:*

An example of this correspondence is:

6*a*) SAA² *ká:f*, B *kháf*, F *ké:f* ("to put him").

Correspondence 6 is evidently the same as correspondence 2, except for vowel length, in those dialects in which this feature occurs. Moreover it is found in verb forms with the same formation as that of 1*b* and 2*a*. The present example belongs more exactly to the most important class of verb stems with two consonants. It is thus parallel to the following form:

6*b*) S *bʔləf*, B *bʔləf*, AA²F *bálef* ("to loosen him"). We therefore have reason to see here an occurrence of the protophoneme **ɔ*. Moreover, it cannot be accidental that, except for length, 6 is identical with 2, the form that **ɔ* takes before **h*, **x*, and **ç*. The natural conclusion is that the same conditioning factor (i.e., a back continuant) must have been present. Note that Proto-Coptic has front continuants **s*, **š*, and *f* which do not exercise this effect. That the last conditioning factor should be voiceless is not a necessary assumption because all the reconstructed fricatives are voiceless and the distinctive features need only be fricativity and back articulation. Because, when consonants are lost, it frequently happens that the preceding vowel is lengthened, we may consider the long vowels of the dialects other than B to be the historical continuation of **ɔ* plus the lost consonant. We will symbolize this consonant as *H₂* and thus reconstruct 6*a* as **kʔH₂f*. Further evidence for the second mora of a long vowel in 6 representing a consonant at an earlier stage is that in A, one of the Coptic dialects, a final unstressed vowel written *ε* develops after a sequence of final consonant plus sonant. For example, A has *satmε* as the qualitative (i.e., stative) of the

verb "to hear" corresponding to S *sótam* (*sót(ə)m). A similarly has final *ε* when a long vowel precedes a sonant, for example, A *yó:ε* ("canal") as contrasted with S *yó:r*. A therefore treats the last mora of a long vowel as though it were a consonant.

It was noted earlier that the long vowels do not normally appear in word-final position; therefore, where correspondence 2 occurs in word final, we should also assume the disappearance of *H*₂. Hence we reconstruct the following word as **lɔH*₂:

6b) SAA²B *lá*, F *lé* ("slander").

Compare 6c) SA² *sáh*, AB *sáx*, F *seh*. **sɔx* ("scribe").

The absence of vocalic length preceding word-final, as contrasted with length before word-medial, preconsonantal *H*₂ can be accounted for in two ways. Either *VH*₂ > *V*: in all environments originally and word-final long vowels were shortened, or word-final *H*₂, unlike medial *H*₂, was lost without lengthening the preceding vowel.⁴⁷

The identify of correspondences in vowel quality between internal long vowels and final stressed vowel is not confined to correspondence 2 but is general throughout Coptic. This fact can hardly be an accident. We, therefore, interpret the pairs of internal long vowels and final stressed short vowels as representing the same vowel in each instance. Whether length in every instance results from loss of a consonant remains provisionally undecided. The evidence outlined below regarding the same vowel **ɔ*, however, strongly suggests a second lost consonant.

We find another matching pair of correspondences between word interior long vowel and final short vowel as follows:

7) SAA² *ó:*, B *ó*, F *á:*

8) SBAA² *ó#*, F *á#*

Examples of 7 and 8 are:

7a) SAA² *bó:nε*, B *bóni*, F *bá:ni* ("be bad").

8a) SBAA² *ró*, F *lá* ("mouth").

Besides the phonetic resemblance of this correspondence to 1, we have morphophonemic evidence that 8, and hence 7, must involve **ɔ*. In the independent pronominal forms of the second and third person, we have a uniform base followed by the pronominal suffixes already quoted in 1b and 6a. This base appears before an overt consonant in the third masculine singular and elsewhere.

8b) S (*ə*)*ntɔf*, B (*ə*)*nthɔf*, AA²B (*ə*)*ntáf*. *(*ə*)*ntɔf* ("he").

⁴⁷Medial *H*₂ usually occurs before a following consonant. Where, however, it is intervocalic, it is normally reflected by a short (i.e., nongeminated) vowel in Coptic.

The stressed vowel here shows correspondence 1 and is, therefore, reconstructed as $^*\acute{o}$. The second person feminine pronoun, however, displays a final stressed vowel with correspondence 8.

8c) SAA² (∂)nt \acute{o} , B (∂)nth \acute{o} , F (∂)nt \acute{a} .

We therefore interpret it as containing the same vowel $^*\acute{o}$. Since correspondence 8 differs from 2 which we interpreted in final position as *H_2 , the consonant involved must be a different one. We symbolize it as H_1 , and hence reconstruct 7a, 8a, 8b, and 8c as $^*b\acute{o}H_1n\partial$, $^*r\acute{o}H_1$, $^*(\partial)nt\acute{o}f$, and $^*(\partial)nt\acute{o}H_1$, respectively.

We now consider the front vowel corresponding to $^*\acute{o}$. The following correspondence of stressed internal short vowel is frequently found:

9) SB \acute{a} , AA²F \acute{e} .

It is possible to cite at least one minimal contrast with $^*\acute{o}$:

9a) SB $b\acute{o}l$, AF $b\acute{a}l$. $^*b\acute{o}l$ ("outside").

9b) SB $b\acute{a}l$, AA²F $b\acute{e}l$ ("eye").

We symbolize this new vowel as $^*\epsilon$, hence $^*b\acute{e}l$ ("eye").

For $^*\epsilon$, we find a contrast between other second and third person suffixes and the second person feminine suffix parallel to that for $^*\acute{o}$ cited in 8b and 8c.

10) SBAA² \acute{e} , F \acute{e} .

The pair of contrasting forms just alluded to are:

10a) SB $n\acute{a}f$, AA²F $n\acute{é}f$. $^*n\acute{é}f$ ("to him").

10b) SBAA² $n\acute{é}$, F $n\acute{é}$ ("to you [f]").

In 10a we naturally reconstruct $^*\acute{é}$ since it represents correspondence 9 as above. In view of the parallelism with (∂)nt $\acute{o}H_1$ ("you [f]"), we posit $n\acute{é}H_1$ as the protoform for 10b.

We should now expect a correspondence word internally involving long vowels and identical in quality with 10, representing $\acute{é}H_1$, in this position as follows:

11) SAA² $\acute{é}$:, B ϵ , F $\acute{é}$:

It is in fact found, as in the following example:

11a). SAA² $m\acute{é}:r\partial$, B $m\acute{é}ri$, F $m\acute{é}:ri$. $^*m\acute{é}H_1r\partial$. We have now found correspondences representing $^*\acute{o}H_2$, $^*\acute{o}H_1$, and $^*\acute{é}H_1$. We have yet to find evidence for $^*\acute{é}H_2$. Here there are apparently no morphophonemic clues; however, we do find another pair of correspondences identical in quality, one involving long vowels in word medial, the other, short stressed final vowels.

12) S \acute{a} :, B \acute{a} , AA²F $\acute{é}$:

13) SB $\acute{a}\#$, AA²F $\acute{é}\#$

13a) S *má:tə*, B *máti*, AA² *mé:tɛ*, F *mé:ti*. **méH₂tə* ("to reach").

13b) S *wá*, AA²F *wɛ* ("one"). **wɛH₂*.

Several observations, however, are to be made regarding 12 and 13. It will be noted that 13 is, in fact, identical with 9, and 12 is also identical with 9, except for vowel length. Thus, **ɛ*, unlike **ɔ*, does not show special protoallophones before those back fricatives that survive in the existing dialects. Hence it is not surprising that before presumed *H₂* it only shows length in word medial and is identical in word final. The other observation to be made is that examples of 13 are difficult to find and the one cited was probably, as shown by Bohairic *wai*, not word final. This form should probably be reconstructed as **wéH₂jə*. The rarity of *H₂* in word final suggests that perhaps **H₂#* > **H₁#* at an earlier stage. With this reservation, as indicated by parentheses, the results thus far are summarized in table 4.

TABLE 4
SUMMARY OF CONSTRUCTED PROTO-COPTIC FORMS

Reconstructed protoform	Corresponding forms in existing dialects					Remarks
	S	B	A	A ²	F	
* <i>ɔ</i>	ɔ	ɔ	á	á	á	Except before <i>h</i> , <i>x</i> , <i>ç</i> , and <i>H</i> Before unvoiced back fricatives as well as before <i>H₂#</i>
* <i>ɔH₂#</i>	á	á	é	é	é	
* <i>ɔH₂</i>	á:	á:	é:	é:	é:	
* <i>ɔH₁#</i>	ɔ	ɔ	ɔ	ɔ	á	
* <i>ɔH₁</i>	ɔ:	ɔ:	ɔ:	ɔ:	á:	
* <i>é</i>	á	á	é	é	é	
(* <i>éH₂#</i>)	(á)	(á)	(é)	(é)	(é)	
* <i>éH₂</i>	á:	á:	é:	é:	é:	
* <i>éH₁#</i>	é	é	é	é	é	
* <i>éH₁</i>	é:	é:	é:	é:	é:	

We now consider evidence for the existence and identity of *H₁* and *H₂* when not immediately following a stressed vowel. In post-stressed syllables, which are always final syllables, only one vowel phoneme is reconstructible. It appears as *ɛ* or *ə* (the supralinear stroke) when followed by final consonant, and as SAA² *ɛ*, BF *i*, when immediately followed by word boundary. In both instances in

the earlier examples it is symbolized as $*\partial$. There is evidently no chance of distinguishing H_1 from H_2 in this position.⁴⁸

In prestressed position, a considerable variety of correspondences is found involving absence of vowel, or differing patterns of occurrences of a or ϵ . In addition we find unstressed i and u which can be shown to represent syllabic forms of j and w in reduced syllables. Earlier the example of $S\ st\acute{o}j$ ("smell") and $st\grave{i}-n\acute{u}fe$ ("smell-good," i.e., "perfume") was cited. We may add here $S\ h\acute{o}w$ ("day") as compared with $h\grave{u}-m\acute{is}\partial$ ("birthday," lit. "day of birth"). There are also instances of liquids and nasals in reduced forms, that is, preceded by the supralinear stroke here transcribed ∂ . In such instances, some scholars interpret ∂r as syllabic r , and analogously for other liquids and nasals.⁴⁹ An example is $S\ sor$ ("to scatter") as an independent verbal form, and the reduced form $s\partial r-$ (interpreted by some as phonetically $s\grave{r}-$) with the following nominal object.

Where in prestressed syllables there is evidence for H_1 or H_2 , we find a reduced vowel appearing as a and ϵ in different dialects in a variety of patterns not yet fully accounted for. That, however, a reduced vowel followed by H_2 may appear as a in all dialects is shown by the verbal forms with final stem H_2 . Thus, parallel to such alternations as $S\ s\acute{o}r$ ("to scatter"), $s\acute{o}r-\partial f$ ("to scatter him"), $s\partial r-$ ("to scatter [something]"), we have $S\ j\acute{o}$ ("to wash"); $j\acute{a}:f$ ("to wash him"); $j\grave{a}-$ ("to wash [something]"). The second of these, $j\acute{a}:f$, shows correspondence 6 as indicated by its form in other dialects, and is, therefore, to be reconstructed as $*j\acute{o}H_2f$. Hence $j\grave{a}-$, which takes this form in all the dialects, goes back to $j(\partial)H_2-$. We shall number this correspondence 14.

14) SBAA²F a (with low or secondary stress).

At this point we resort to the causative formations with prefixed $t-$ to give us information regarding the reflexes of H_1 and H_2 in prestressed syllables. A verb such as $*\zeta\acute{o}p\partial$ ("to become") has a causative which, on the basis of correspondences previously cited, is $t\zeta p\acute{o}H_1$. Hence, when we find SB $a\acute{s}\acute{a}j$, AA²F $a\acute{s}\acute{e}j$ ("to be many"), alongside its causative SBAA² $ta\acute{s}\acute{o}$, F $ta\acute{s}\acute{a}$, we may, in conformity with our interpretation of $ja-$ with vowel correspondence 14 as $j(\partial)H_2$, reconstruct $*(\partial)H_2\acute{s}\acute{e}j$ and $*t(\partial)H_2\acute{s}\acute{o}H_1$, respectively. A different correspondence, 15, is found in other causatives:

⁴⁸However, as Polotsky (1939) shows, H_2 is under certain statistically rare conditions reflected as Fayumic ϵ instead of i .

⁴⁹On this point see Till (1951) and the literature cited there.

15) SBF a , AA² ϵ

An example is SB *takó*, AA² *tekó*, F *taká* ("to destroy"), for which the simplex does not exist in Coptic. Since nonlaryngeals have either zero or the supralinear stroke α , it seems reasonable to attribute this correspondence to our missing H_1 . Hence we posit $^*(\alpha)H_1kóH_1$ in this and similar instances.

All verbs that appear in noncausatives with initial vowel without preceding consonant, when they have causatives, show either 14 or 15 in the initial syllable. Thus S *ón(α)h* ("to live") has the causative in S *tanhó*, in which the initial syllable shows correspondence 14. Hence it seems reasonable to reconstruct the simplex as $H_2ón(\alpha)x$, and the hypothetical noncausative of $^*t(\alpha)H_1kóH_1$ ("to destroy") as *H_1ók ("to perish"). Evidently initial H_1 or H_2 is lost before a stressed vowel.

Since we may consider the specific set of verbs which have a *t*-causative as a reasonable sample of Coptic verbs, the fact that every verb with initial stressed vowel in Coptic displays reflexes of either H_1 or H_2 when it has a *t*-causative leads to the conclusion that all initial stressed vowels in Coptic formerly had H initially; but, of course, where no alternation exists we can only reconstruct with a cover symbol H because we cannot tell which of the two it is.

Because, in the form $^*(\alpha)H_2šěj$ ("to be many"), H_2 appears as correspondence 14, we may expect examples of 15 in similar position to reflect $(\alpha)H_1CV \dots$; as in the following examples:

15a) SB *awán*, AA² *ewén*, F *awén* ("color").

We accordingly reconstruct $^*(\alpha)H_1wén$.

A further fairly common initial unstressed vowel correspondence preceding CV ... is the following:

16) SBAA²F ϵ

as is found, for example, in

16a) SBAA²F *esét* ("ground").

Because we have not accounted for initial sequences in which the laryngeal is in the second position and have seen that before an initial stressed vowel H is simply zero, we may suspect that 16a represents an earlier $^*(\alpha)sHét$. Here again, before a stressed vowel there is no way in the absence of alternations to decide between H_1 and H_2 . Evidently H_1 and H_2 may modify the quality and length of preceding vowels but exercise no such effect on the succeeding vowel.

We have gone about as far as it is possible to go on Coptic alone. The reconstructed units symbolized here as H_1 and H_2 appear consistently in earlier Egyptian as consonants that can be considered

phonetically a glottal stop (ʔ) and voiced pharyngeal (ʕ), respectively.⁵⁰ The only real point of discrepancy is that, in all dialects, forms with prestressed *a*, which, on the basis of alternations in causatives, was reconstructed as (ə)*H*₂, reflects (ə)*H*₁ in a fair number of instances; for example, SB *anɔk*, AA²F *anáḱ*, which goes back to Egyptian (ə)*ʔnɔḱ*, rather than to *(ə)*ʕnɔḱ* = (ə)*H*₂*nɔḱ*.

We may summarize the reflexes of *H*₁ and *H*₂ in the following list; its parallelism to the most commonly posited developments of the Indo-European laryngeals should be obvious.

1) Nonfinal laryngeals following a stressed vowel are lost and produce length.

2) Final laryngeals are lost without producing length.

3) Laryngeals preceding a vowel do not produce length.

4) Certain laryngeals change the vowel quality of certain preceding vowels.

5) Laryngeals in reduced syllables are accompanied by reduced vowels which survive where vowels with nonlaryngeals under the same accentual condition are lost.

6) For this reduced vowel, it is impossible to tell which vowel has been reduced (e.g., **ε* or **ɔ*), but the laryngeal involved is identifiable in certain forms (e.g., the causatives).

7) An initial sequence of nonlaryngeal consonant plus laryngeal plus vowel develops a preceding, low-stressed shwa, whereas sequences of nonlaryngeals have no initial vowel.

8) Long vowels developing from laryngeals followed by *w* or *y* display a marked tendency to shorten the resulting long diphthong. (This point has not been illustrated. Compare Indo-European treatment of *e:u* and similar combinations.)

9) Laryngeals tend strongly to metathesis, which usually results in their preceding consonants they formerly followed. (An example is S *šópε* ["become"] < **šóp(ə)H*₁, as compared with the qualitative *šó:p* < **šóH*₁*p* in which Egyptian indicates that the original sequence was *s-p-H*₁.)

10) Intervocalic laryngeals are lost without producing vowel length, but they often change preceding vowel color. (This point, likewise, was not illustrated here.)

⁵⁰Such at least seems to be the situation not long prior to the Coptic period. However, ʔ represents two apparently different Egyptian sounds, one *y*-like and the other possibly a glottal stop. Both of these may appear in Coptic as *i* in stressed syllables but under further conditions that cannot be specified on the basis of present evidence. In addition, some instances of Proto-Coptic *H*₁ arise from earlier *r* and *t* which sometimes apparently become ʔ.

11) All words that begin in the existing dialects with a stressed vowel originally had an initial laryngeal.

With regard to the development of vowel length in sequences consisting of vowel plus laryngeal plus consonant, it may be pointed out that the common formulation of this process as "compensatory," implying perhaps a feeling of collective guilt at having repressed a consonant, conceals the phonetic problem involved. Here the evidence of Hebrew is valuable because it shows, precisely before consonants but not when the consonant is word final, the development of an extra vocalic segment with the same vowel quality as that of the vowel preceding the laryngeals. These are the so-called *Hatephs* or "hurried shwas," for example, *ya'amód* ("he stands") < **ya'mód*. The sequence *ya'a'mód* < *ya:mód* as a possible further development is easily understandable; and this development actually occurred with regard to the glottal stop in Hebrew in the pre-historic period, for example, *yo:mér* ("he speaks") < **ya:mér* < *ya^hmér*. Compare also Western transcriptions of Arabic words such as *Kaaba* = Arabic *ka'ba* and the existence of "echo vowels" in some Amerindian languages after ^h.

As a final principle of dynamic comparison, we consider the intragenetic mode. The following may serve as a preliminary characterization. The comparison is confined to a genetically delimited group of languages. Empirical hypotheses of a diachronic nature are advanced. They are empirical in the sense that it is clearly stated what would constitute a violation. They are diachronic in that they refer to linguistic changes within the family. Typically they take on one of two forms. Either they state that, of two or more mutually exclusive changes, only one may take place (although the change is not inevitable, its alternatives are denied) or that, of several changes, one must take place earlier than the others.⁵¹ Here again, it is not stated as inevitable that the change *will* take place. Only the order of their occurrence is predicted if they do materialize. Although the hypotheses are stated in terms of properties of a particular language family (e.g., they may mention such categories as "weak verbs in English," "palatalized consonants in Celtic"), they may be viewed as exemplifications of universal diachronic hypotheses in which the variables have been filled in with proper name specifications.

⁵¹These two types of statements are equivalent to the diachronic universals discussed in Greenberg (1966b).

Intragenetic comparison is illustrated here with reference to the Slavic system of nominal declension. Attention was initially directed to this topic, because of a problem that arose in connection with the well-known overall tendency in languages for certain categories (the so-called unmarked) to receive zero expression, while opposing marked categories typically have overt expression. Apparently contravening this principle is the well-known existence in some Slavic languages of extensive classes of nouns (basically the hard feminines and neuters) which show the opposite of the expected phenomenon. Although the singular is to be considered unmarked as against the plural, and the direct cases (nominative, accusative) as unmarked in comparison with the oblique cases (genitive, dative, instrumental, locative), these languages have, in certain classes of nouns, an overt desinence for the doubly unmarked nominative singular and a zero for the doubly marked genitive plural. This fact may be illustrated by the following examples from Standard Czech: *žena* (nom. sing.), *žen* (gen. pl., "woman [f]"); *město* (nom. sing.), *měst* (gen. pl., "city [n]"). On the other hand, there is also an extensive set of nouns which does show the expected type of ending, for example, *hrad* (nom. sing.), *hradů* (gen. pl., "castle" [m]). Hence Czech and the other Slavic languages that show analogous phenomena do not constitute exceptions to the principles stated provided one specifies that in no language does a marked category have zero as a sole allomorph; but such a statement is not really satisfactory because it is well known that the zeroes in both instances, where predicted, as in the nominative singular, and contraindicated, as in the genitive plural, arose by the same sound change, the loss of the *jers* (*ũ* and *ĩ*) still found in Old Church Slavonic. Thus the present nominative singular *hrad* and genitive plural *žen* at an earlier period possessed overt endings as seen in the corresponding Old Church Slavonic forms *gradũ* and *ženũ*.

The loss of *ĩ* and *ũ* in all word-final and certain word-medial positions conforms to certain typical conditions for vowel loss, as was pointed out in the earlier discussion of unvoiced vowels. As a phonological phenomenon it therefore makes sense; but it is, of course, but an illustration of what has been a commonplace since the time of the neogrammarians. Its effects on the morphological system are random, producing by the very same change zeroes in categories where they are both expected and unexpected. If this were the whole story, how would one find the extensive conformity to certain synchronically stated principles, such as the preference of

unmarked categories for zero and marked categories for overt expression, which in fact exists?

The answer may be expected to lie in the direction of certain dynamic selective tendencies. Synchronic regularities are merely the consequences of such forces. It is not so much again that "exceptions" are explained historically, but that the true regularity is contained in the dynamic principles themselves.

These principles, where morphology is concerned, may be expected to lie chiefly in the area of analogical change viewed as the spread of one allomorph at the expense of another. The loss of final *jers* in Slavic produced, in effect, a laboratory situation in that it resulted in zero allomorphs both in a category in which they should be favored (nominative singular) and disfavored (genitive plural). We may now consider the situation resulting from the loss of *jers* separately for each of these two categories, beginning with the genitive plural.

Because the ending of the genitive plural was \tilde{u} in most declensional classes, the dropping of final \tilde{u} produced a situation in which zero was by far the most common allomorph occurring in all three genders and in the most numerous classes in each; however, after this change, there did remain two overt endings. The masculine *u*-stems, a very restricted class, had in Old Church Slavonic the ending *-ov \tilde{u}* , historically the same ending as \tilde{u} , since *-ov-* derives from an original *o*-grade in stemfinal *u/w* nouns. This *-ov \tilde{u}* , of course, became *-ov*. The *i*-stems, which were chiefly feminine but included some masculines in Old Church Slavonic, had an ending *- \tilde{ij} \tilde{i}* from earlier *- \tilde{ij} \tilde{u}* . With loss of final \tilde{i} , this ending became *- \tilde{ij}* , which takes various forms in the Slavic languages. When the *- \tilde{ij}* was stressed, it became *- \acute{ej}* in Russian, and I shall use *-ej* as the citation form for this allomorph. To summarize, with loss of final *jers* the genitive plural had three allomorphs zero \sim *ov* \sim *ej*, of which the first was by far the most frequent.

In the nominative singular, both \tilde{u} and \tilde{i} existed in certain extensive categories of nouns. When \tilde{i} was lost, it left a trace in the palatalization of the previous consonant (unless this was already "soft" because of an earlier *-i-*). The ending \tilde{u} existed in the nominative singular of hard *o*-stems, the dominant category in masculine nouns, and in *u*-stems, a limited group, as has been seen. In masculine soft stems (i.e., those historically with stem final *-i*), by a regular prehistoric change already exemplified above for the genitive plural of *i*-stems (*- \tilde{ij} \tilde{i}* < ** \tilde{ij} \tilde{u}*), the nominative singular had \tilde{i} . An example

is the word for "man" in Old Church Slavonic, which, in the nominative singular, is *mŏžŭ* < **mŏgŭ* < *mŏgŭ*. In addition the *i*-stems, whether masculine or feminine, had the ending -*ŭ* in the nominative and accusative singular. All of these categories, therefore, had zero after the loss of the *jers*. On the other hand, no neuter had -*ŭ* or -*ŭ* (most had -*o* for hard stems, -*e* for soft stems), and the dominant feminine class of *a*-stems had the overt ending -*a* in the nominative singular. In the nominative singular, then, after the loss of *jers*, zero was the dominant ending in masculine nouns, was present in a substantial minority of feminines (the *i*-stems), and occurred not at all in the neuter. The alternants for the nominative singular were, then, *a* ~ *o* ~ *e* ~ zero.⁵² Hence, after the loss of the *jers*, zero was the dominant allomorph in the category in which it should not be expected (genitive singular), and only one of several common allomorphs in a category in which it should be expected (nominative singular and the accusative singular of inanimates that are, in Slavic, identical in the nominative and accusative).

With regard to the genitive plural, we hypothesize that of the three alternants zero, -*ov*, and -*ej*, the first will never replace the second or third. If there are any instances of analogical spread, it will be at the expense of the zero allomorph. The historical evidence is, in fact, in favor of this hypothesis. In particular, -*ov* has tended to spread at the expense of the zero ending. In one language, Upper Lusatian, except for a small remnant with zero, all of the nouns in the language have -*ov*. In Russian dialects, -*ov* has spread to hard feminines and neuters (e.g., *knígov*, *mestóv*) so that practically all nouns have overt genitive plural endings. In the Serbo-Croatian literary language, all nouns have nonzero genitive plural endings, the dominant form being -*a*: of still mysterious origin, but with -*í* < *ej* also in certain nominal classes. It is fair to say that, in every single Slavic dialect or standard language, zero has lost ground. Nowhere is it now the dominant allomorph, and in some instances it has almost completely disappeared. The only exception to the spread of nonzero endings of which I am aware is that in Polish, from the fifteenth to the eighteenth century, a small number of *i*-stems replaced their inherited ending by zero (e.g., *myszy* [gen. pl.,

⁵²I have not included here the various forms of the nominative singular (or the neuter nominative-accusative singular) which involve truncation of the stem common to the remaining cases, for example, the feminine *u*-stems that have nominative singular -*y* and, in the remaining cases, -*ov* plus the usual consonant stem endings. Such truncations behave like nonzeros. All of these classes have a severely restricted membership.

“mice”] with *-y* < *-ej* was replaced by *mysz*).⁵³ This trend was subsequently reversed, and modern Polish has *myszy*.

The inverse hypothesis concerning the nominative singular is, of course, that the nonzero allomorphs will not gain ground at the expense of the zero allomorph. If there is any change, it should be in the opposite direction. This hypothesis appears to be verified by the historical evidence from Slavic languages without exception. I do not know of a single instance in which the zero of the masculine basic *o*-/jo-stems and *u*-stems, or that of the *i*-stems, has been replaced by an overt ending. At the same time, the overt endings *-a* for the feminine, *-o*-/*-e* for the neuter have in general been maintained, since they have a function within the gender system, marking the feminine and neuter as against the zero of the masculine. The situation in the nominative singular in Slavic after the loss of *jers* is represented in table 5 for the major declensional classes.

TABLE 5
SLAVIC NOMINATIVE SINGULAR AFTER LOSS OF JERS

Gender	Hard	Soft
Masculine	zero	'zero
1. Feminine (<i>a</i> -stems)	<i>a</i>	' <i>a</i>
2. Feminine (<i>i</i> -stems)	'zero
Neuter	<i>o</i>	' <i>e</i>

Nevertheless, where there has been change in this relatively stable situation, it has been in the direction of the spread of zero to the feminine *a*-stems, rather than vice versa. This change has taken place in West Slavic and has gone farthest in Upper Lusatian and in Slovak. Here the *i*-stems have coalesced with the soft *a*-stems; and, in the merged declension, it is precisely the zero of the nominative-accusative which has been carried over from the *i*-stems, whereas all the other inflections come from the *a*-stems. The same tendencies are noticeable in Polish and in Czech. In the latter, an intermediate declension has arisen (e.g., *dlaň*, “palm of the hand”) alongside the *a* and *i* feminine declensions with the zero of the nominative-accusative singular from the *i*-stems and the remaining forms from the *a* declension. These are former *a*-stems that have

⁵³Klemensiewicz *et al.* (1955), p. 299.

replaced their overt endings of the nominative and accusative singular with zero, and not former *i*-stems that have acquired the remainder of their inflection from the *a*-stems.

Both hypotheses then, the favoring of the zero alternant in the nominative singular and the overt alternant in the genitive plural, are verified by the historical linguistic data.

We have seen that, in the genitive plural, after the loss of the *jers*, there were three alternants zero $\sim ov \sim ej$. Our first hypothesis stated that zero was disfavored as against the two overt allomorphs. We may now inquire whether it is possible to set up any hypothesis regarding the relation between *-ov* and *-ej*.

There are certain expectations based on the observation of these and similar instances. Thus, other things being equal, we may hypothesize that *-ov*, which was originally the genitive plural of a masculine "hard" (nonpalatalized) declension, will more easily spread into a masculine than a feminine or neuter declension, and into a hard declension than a soft declension. Such statements are easily converted into refutable diachronic implications. Spread of *ov* into a feminine or neuter class implies previous spread into a masculine class, and so on.

In the present instance, there is just one declensional class, the masculine *o*-stems, which agrees in gender and nonpalatality with the *u*-stems. We may, therefore, advance the hypothesis that spread to any other class implies previous spread to this class. Because the third genitive plural alternant *-ej* belongs initially to a soft declension which is predominantly feminine with a few marginal masculines, *-ov* will be favored over *-ej* for the masculine *o*-stems.

Such is, in fact, the case, in that wherever else it may spread, it is also found in this class, and that where it is found in several declensions, the direct historical evidence shows its prior presence in the masculine *o*-stems; however, this development is not an independent event in the various Slavic languages. These two declensions have already largely merged in Old Church Slavonic, the original *u*-stems being distinguishable on the whole by greater frequency of inflectional variants stemming historically from the *u*-declension. Hence, the process started before the loss of *jers* with the consequent zero allomorph in the genitive plural of the *o*-stems. The initial conditions for this merger were the resemblance in gender and nonpalatality, but it may be conjectured that the agreement of both declensions in having $\sim \tilde{u}$ in the most frequent (unmarked)

cases, the nominative and accusative singular, was a precipitating factor in the merger.⁵⁴ I shall return to this point later.

In the course of the merger, individual Slavic languages often retained inflections inherited from both declensions, sometimes with secondary redistributions of function. Nevertheless, the inflections of the far more numerous *o*-class were normally dominant. It is precisely in the genitive plural, where the Slavic languages, after the loss of final *ŭ*, inherited a zero from the more numerous *o*-stems and *ov* from the *u*-stems, that the triumph of the *u*-stem inflection was most widespread and complete. Thus, Vaillant summarizes the result of the merger insofar as it concerns the survival of original *u*-stem inflections in the following terms: "L'extension de ces désinences est très limitée. Elle est plus notable au nominatif et surtout au génitif pluriels."⁵⁵

We may seek to generalize concerning the factors involved in declensional merger which were seen to operate in the instance of the hard *o*- and *u*-stems. Agreement in palatality, gender, and identity of inflection in the nominative and accusative singular may be conjectured to be necessary and sufficient conditions for merger; and, where other factors such as marking do not intervene, the forms of the more frequent declension will triumph. Such a thesis involves, of course, factors that, while not exclusively confined to Slavic (e.g., gender and the distinction of palatal and nonpalatal stems), are sometimes absent in other instances; therefore, it would have to be restated for certain other families of languages.

This particular thesis is verified in a whole series of instances in Slavic; however, statement in the form of necessary and sufficient conditions is not an empirical formulation, as can be shown from the following example. There were in early Slavic three classes of neuter consonant stems, all small in number and having as a common feature the possession of two forms of stem, a shorter in the nominative and accusative singular (in neuters, the nominative and accusative are the same in all numbers), and a longer, containing what is, from the synchronic point of view, an "extension," for the remaining cases of the singular and the entire plural. On the basis of these extensions, we may call them the *en*-, *ent*-, and *es*-stems.

⁵⁴Josselson (1953) reports for conversational Russian a frequency of 50.7 percent for the combined nominative and accusative singular and 49.3 percent for all remaining cases.

⁵⁵Vaillant (1950-1958), II, 91.

TABLE 6

Stem ending	Case		Definition
	Nominative-Accusative Singular	Genitive Singular	
<i>-en</i>	<i>vremę</i>	<i>vremen-e</i>	"time"
<i>-ent</i>	<i>otročę</i>	<i>otročęt-e</i>	"infant"
<i>-es</i>	<i>slovo</i>	<i>sloves-e</i>	"word"
<i>-o</i>	<i>sel-o</i>	<i>sel-a</i>	"village"

In table 6 the shorter stem of the nominative-accusative singular is given along with the genitive singular to exemplify the extended stem. In addition the hard thematic *o*-stem neuters, the dominant neuter class, and one without extensions, are included. The forms cited are from Old Church Slavonic. The conditions for merger between the *es*- and *o*-stems are evidently present because, in addition to gender and nonpalatality, there is the factor of agreement in the nominative-accusative singular *-o*. We likewise hypothesize that the more frequent *o*-stems will triumph, so that we may expect that, as the result of merger, words like *slovo* will have genitive singular *slova* in place of *slovese*, and will similarly coincide with *selo* in the remaining forms of their declension. Here again the process has already commenced in Old Church Slavonic, and the dominance of *o*-stems is clear in that, on the whole, only original *es*-stems have variant forms from the two declensions. The process is complete in practically all contemporary languages; however, that Old Church Slavonic probably represents the merger in incipient form not yet carried through everywhere in Slavic territory is shown by modern Slovene, which still retains the distinction between *o*- and *es*-stems. We can always say that the merger will eventually take place in Slovene also, but we have waited roughly 1,000 years and it has not occurred. Hence predictions of this kind without a stated time limit are not empirically refutable. We can always wait longer for it to occur. On the other hand, Slovene has also kept the other neuter consonant declensions separate from the *o*-stems; hence, the familiar implicational thesis holds here as elsewhere in Slavic and can be stated in the following terms: Merger of the *en*- and *ent*-stems with the *o*-stems implies previous merger of the *es*-stems with the *o*-stems. The decisive importance of identity in the nominative-accusative singular is further shown by the occurrence of merger of these other classes with the *o*-stem, or its palatalized counterpart, the *e*-stems, when further phonetic change produces

identity in the unmarked nominative-accusative singular (e.g., *en-stems* in Ukrainian).

We may note that in the three neuter consonant classes we are once again close to a "laboratory" situation in which *cetera* are indeed *paria*. The three consonant classes agree in gender and non-palatalty but differ in the factor of identity in the unmarked cases with the thematic neuter declension.

Because the combined frequency of the oblique singular together with the entire plural is roughly equal to that of the nominative-accusative singular, we might have expected that, in merging with the *o*-stems, the *es*-stems could have analogized in the opposite direction, generalizing the extended stem to produce a declension **sloveso* (nom.-acc. sing.), **slovesa* (gen. sing.), and so on. In fact, such a development has taken place rather widely with just one noun of the *es*-class, namely *kolo* ("wheel"). Russian, Ukrainian, Lower Lusatian, and Slovak all agree in generalizing the extended stem in just this word, and Upper Lusatian has *koleso* and *kolo* as doublets. Kuznetsov conjectures that the survival of the *-es* form in this word in Russian is the result of the frequency of its use in the plural.⁵⁶ If his conjecture is correct, then the nominative and accusative plural may be expected to be the most frequent cases, and these, of course, have the *-es* extension.

Thanks to the data provided by Steinfeldt, who gives the frequencies for individual inflectional categories of all the more frequent nouns in modern Russian, it is now possible to test this thesis, at least insofar as it pertains to Russian.⁵⁷ In table 7 are listed all words that have survived in modern Russian of the words cited by Diels in his Old Church Slavonic grammar as belonging to the *-es* declension.⁵⁸ We see, indeed, that *kolo* is most frequent in the plural.⁵⁹ Generalizing the example of *kolo*, we may say that a set of relative frequencies can be mapped into a chain of diachronic implicational hypotheses. Of course, due regard would have to be

⁵⁶Kuznetsov (1953), p. 83.

⁵⁷Steinfeldt (1965).

⁵⁸Diels (1932), p. 169.

⁵⁹Slovak has doublets *telo-teleso* and *slovo-sloveso*. For both pairs, the forms in *-eso* are neologisms, of lesser frequency and with specialized technical meanings, as noted in Stanislav (1957-58) II, 231. The same is true in Czech. Thus *telo* is "body" in the ordinary sense, *teleso* is a solid in geometry; *slovo* is "word," but *sloveso* is a modern coinage meaning "verb." It should likewise be noted that the modern representatives of Old Church Slavonic, *nebo* ("sky") and *cudo* ("miracle") often have *-es* extensions in the plural only, which is recognized as an example of Old Church Slavonic influence.

TABLE 7
RUSSIAN SURVIVALS OF *-es* DECLENSION

Modern Russian word belonging to <i>-es</i> declension	Frequencies according to Steinfeldt		Definition
	Singular	Plural	
<i>nebo</i>	97	3	"sky"
<i>telo</i>	95	5	"body"
<i>lico</i>	84	16	"face"
<i>delo</i>	75	25	"thing"
<i>čudo</i>	54	46	"miracle"
<i>slovo</i>	53	47	"word"
<i>derevo</i>	44	56	"tree"
<i>keleso</i>	16	84	"wheel"

given to the statistical significance of the frequency differences. Thus, if any word on this list generalizes the *es*-stem, it should be *kolo*. The generalization of the *es*-stem in *slovo* implies its generalization in *derevo* and *kolo*, and so on.

It will not be possible in the present connection to illustrate the further series of intragenetic hypotheses verified by the historical evidence even in this one relatively restricted domain of morphological change. Other areas of change, not touched on at all, include, for example, the elimination of inflectional categories as such by merger or by replacement through syntactic constructions. An instance of the application to another linguistic family of one of the principles discussed here in reference to Slavic is the following: In Old High German, through phonetic change, the dominant allomorph of both the neuter singular nominative-accusative and the neuter plural nominative-accusative was zero. The single overt allomorph for the plural involved the suffix *-ir* and internal vowel change (e.g., OHG *lamb/lembir*), and it was restricted to a handful of nouns. Its subsequent spread would be predicted as a further instance of the principle involved in the expansion of *-ov* and *-ej* in the Slavic genitive plural. Ultimately all German neuter plurals acquired overt marking.

Although I believe that the specific examples presented here are novel, I do not imply that the application of such modes of comparison has been completely lacking in the previous literature.⁶⁰ What I believe to be an innovation is the attempt to indicate in a

⁶⁰For example Allen (1957-58), Kurylowicz (1964), and Manczak (1957-58).

systematic way the manner in which such studies transcend the comparative method in the usual sense and the proposal to study some particular phenomenon, for example, vowel nasalization or voiceless vowels, by bringing in all the evidence available on a worldwide scale and in historically independent instances. None of the present extended examples could, for obvious reasons, be presented as an exhaustive study. It may be hoped, however, that the details presented are sufficient for illustrative purposes.

In summary, the four approaches described here are basically similar in that they involve, in varying combinations and from varying points of view, the deployment of the methods of internal reconstruction, comparative reconstruction, and direct historical documentation in order to arrive at universal diachronic principles. These take the form of theories of relative origin (e.g., of nasalized vowels, tonal systems, gender), or of implicational relations among changes (e.g., that low vowels do not become voiceless earlier than high vowels). Synchronic typologies function merely as heuristic, though often indispensable, devices in defining the problems and in assembling the relevant data.⁶¹ Thus it makes sense, I would maintain, to compare all the languages exhibiting some particular phenomenon (e.g., voiceless vowels, laryngeals, nominal case systems, etc.). So, likewise, the method of synchronic universals, which is inextricably involved with typological comparisons, has limitations, as has already been pointed out in the body of this paper by the citation of several instances where it was seen that the true regularity lies in the dynamic tendencies, that is, the diachronic universals.

We may illustrate this dominance and the purely auxiliary role to be assigned to synchronic static regularities, at least in regard to contingent linguistic phenomena, by reverting once more to one of the problems raised in connection with voiceless vowels. It was pointed out that we could not state as a synchronic universal that voicelessness in an earlier portion of a vowel implied voicelessness in the remainder because, at least on the hypothesis that *h*-sounds were, in some instances, voiceless vowels, the sequence forbidden by this law exists but is generally interpreted as *h* + vowel (e.g., *ga* = *ha*). If, however, we state the hypothesis as a diachronic implication, it will be true as far as the evidence with which I am familiar goes that when vowels *become* voiceless this process may

⁶¹For a discussion of some of the limitations of typologies, see Greenberg, 1966a, p. 82.

initially effect only the latter part of the vowel but never merely the initial. On one phonetic assumption, at least, that some sounds labeled *h* are merely voiceless vowels, the difference between the two is that *h* arises from previous consonants, and *V*, from previous vowels.⁶² This difference would sometimes, at least, appear in a generative grammar in the form of the rules in the phonological component. This general topic is reserved for later treatment.⁶³

Finally, three types of limitations in the present treatment of diachronic hypotheses should be pointed out. The first pertains to the possibility of explaining (i.e., deducing) these from more general phonetic or semantic principles. Such explanations are often feasible, or at least reasonable suggestions may be made. For example, high voiceless vowels are probably more easily distinguishable than low voiceless vowels. Moreover, previous consonants often have initially redundant palatalization or labialization which carries most of the burden of differentiation and may ultimately carry all of it after the loss of the vowels. This limitation of interpretation was purposely adopted as not within the scope of the present paper.

⁶²Voiceless vowels seem to be exceptional in that definitions based solely on articulatory and/or acoustic phenomena without regard to distribution or historical origin are normally adequate at least for the heuristic purposes of defining typologically a set of languages within which generalizing comparisons can be carried out. The definition of voiceless vowel given earlier seems adequate for a singling out of the set of languages within which comparison may operate insofar as it delineates the property "to have a voiceless vowel." It is unrevealing, however, in the following respect: Where a voiceless vowel in accordance with the definition occurs, say in final, but in its regressive spread only affects the terminal portion of the vowel of the previous syllable, this latter segment has predictable quality and is, hence, *h* rather than a voiceless vowel by the earlier definition. This definition is clearly unsatisfactory, although it does serve the initial purpose of classifying the language itself as having a voiceless vowel.

⁶³The following remarks are of a provisional nature. In phonology, at least insofar as generative rules restate sound changes of the past, regularities in the form of limitations in the types of possible changes can be stated as conditions on such rules as they appear in descriptions. It is, however, not clear in practice to what extent higher level representations are required to represent earlier lower level realizations. Thus Harms, in his treatment of Southern Paiute (1966-B), at one stage of representation puts stress on every syllabic including voiceless vowels and then erases some of them, including those on the voiceless vowels. Perhaps this generative phonology is not satisfactory; but if it is not preferred to alternative statements of the same weak generative power, the evaluation criteria employed will come from the phonetic plausibility of both the representations and the changes, and these are subject to independent verification by the evidence of ordinary phonetics and the well-established methods of internal reconstruction and comparative linguistics proper.

A second limitation is that diachronic changes were studied only in relation to immediate conditioning factors and to the hierarchy among obviously connected changes, not in relation to the rest of the system. Thus we did not ask what other characteristics might exist in languages which might serve to explain why nasalized vowels develop in some languages but not in others. Virtually all languages have the initial conditions, namely nasal consonants adjacent to vowels, which might lead to the genesis of nasalized vowels. It is the largely unfulfilled promise of structuralism that such conditions exist. They deserve continued investigation, but it seemed preferable as a matter of scientific tactics to investigate first those areas in which success seems more likely and is indeed a probable prerequisite for the wider problem. Until we know what hierarchies of change exist in fact, we cannot investigate the synchronic structural conditions of their appearance.

The third limitation is very likely an extension of the one just mentioned. It has been aptly named by Herzog, Labov, and Weinreich the riddle of actualization.⁶⁴ Why does a specific type of expectable change materialize in one language and not in another, and why does it come into being at one period of a particular language and not another? Thus we hypothesized that the Slavic *es*-declension would merge with the *o*-declension neuters sooner than certain other declensions; but why have they all remained distinct in Slovene to the present day, while other Slavic languages merged them at earlier dates? When stated in this form, our problem admits of a wider search for relevant variables than the internal structural factors mentioned earlier. We might turn to possible sociolinguistic and cultural conditions, though here also the search has heretofore been largely profitless, and it may be that, in the words of Poincaré, we must, in the end, say *ignorabimus*.

⁶⁴M. Herzog, W. Labov, and U. Weinreich (1967).

Bibliography

Abbreviations

AL	<i>Anthropological Linguistics</i>
BSOAS	<i>Bulletin of the School of Oriental and African Studies</i>
IJAL	<i>International Journal of American Linguistics</i>
WZKM	<i>Wiener Zeitschrift für die Kunde des Morgenlandes</i>
ZPAS	<i>Zeitschrift für Phonetik und allgemeine Sprachwissenschaft</i>

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